AUGUST

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Periodontoclasia—*Dement*
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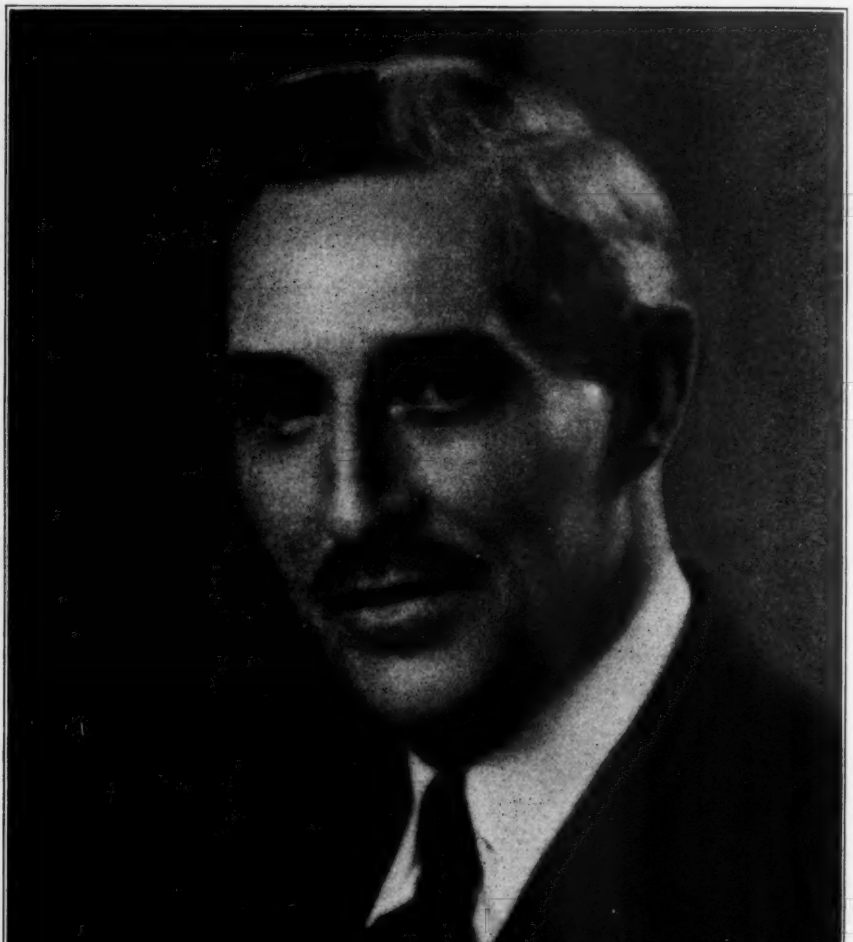

BERT BOYD, D.D.S., Los Angeles, Calif.
President of the Pacific Coast Dental Congress

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

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Original Communications

A STUDY OF ZINC PHOSPHATE CEMENT BY A GROUP OF PRACTICING DENTISTS UNDER THE DIRECTION OF THE A.D.A. RESEARCH FELLOWSHIP AT THE NATIONAL BUREAU OF STANDARDS*

By R. H. VOLLAND†, M.Di., D.D.S., M.D., D.Sc., F.A.C.D., Iowa City, Iowa; and GEORGE C. PAFFENBARGER‡, D.D.S.; and W. T. SWEENEY‡, A.B., Washington, D. C.

PURPOSE

DURING the last two years, the dental research workers at the National Bureau of Standards have been studying the zinc phosphate cements. The detailed reports of this work have been published.[1] The Research Commission of the American Dental Association desired that some of the findings of these investigators be confirmed in a series of simple experiments which the practicing dentist could perform in his own office. When the Commission made this request, it had a three-fold purpose: (1) to compare the laboratory results of the National Bureau of Standards Group with those obtained by the dentist; (2) to obtain data from these groups of dentists that would assist the workers at the Bureau of Standards in formulat-

*A Report to the Research Commission of the American Dental Association.

*Publication authorized by the Executive Board of the Research Commission.

*Read in part at the New York Centennial Meeting, Dec. 4, 1934, and in part at the Mid-Winter Clinic of the Chicago Dental Society, Feb. 19, 1935.

†Chairman, Bureau of Standards Committee of the Research Commission of the American Dental Association.

‡Research associate of the American Dental Association at the National Bureau of Standards.

1. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Preliminary Report on Zinc Phosphate Cements, J.A.D.A. 20:1960-1982 (Nov.) 1933; Zinc Phosphate Cements—Physical Properties and a Specification, ibid., 21:1907-1924 (Nov.) 1934.

ing a specification for these cements; (3) to disseminate the results of the work from the Bureau of Standards laboratory rapidly by giving a group of dentists a series of tests for study and experimentation. These dentists were to present the results of these studies before their local and state societies. This plan worked satisfactorily when previously used in a study of cast gold inlay technics.[2]

The experiments were outlined by Wilmer Souder, chief of the dental laboratory; Aaron Isaacs, associate chemist, and George C. Paffenbarger and W. T. Sweeney, research associates of the American Dental Association.

The 162 practicing dentists who conducted the experiments were selected by the Bureau of Standards Committee of the Research Commission consisting of R. H. Volland, chairman, Harry E. Kelsey, and C. T. Messner, secretary.

TABLE 1.—TABULATION OF COOPERATING DENTISTS' REPLIES TO QUESTION NO. 1

Brand of Cement	Number of Users
Ames	19
Caulk	26
Fleck	29
Harvard	1
Smith	4
Stratford-Cookson	1
White	37

In each locality where a group of cooperating dentists were located, one member served as a contact man, through whom all business was transacted. This shortened the routine executive duties, making it possible to work with a large number of dentists. The contact men (starred), the cooperators in their respective groups, and their locations are as follows:

California: Oakland
- J. W. Roush*
- J. B. Benediktson
- Russell Clinkenbeard
- Chester Cusick
- E. L. Dow
- Everett Finger
- Willard Fleming
- M. L. Grimsley
- Wilfurth Hellman
- M. Thayer Rhodes
- Wilfred H. Robinson
- Robert J. Seeliger
- George G. Smith
- Ellis Thompson

District of Columbia: Washington
- Ralph L. Morrison*
- V. V. Bele
- J. W. Brown
- J. R. Hogan
- E. E. Merriman
- H. A. Swanson

Georgia: Atlanta
- Malvern D. Huff*
- W. A. Garrett
- J. Russell Mitchell
- Roy D. Mitchell

Government Services

Army, Washington, D. C.
- William T. Scheumann*

Navy, Washington, D. C.
- Ronald Barber*

U. S. Public Health Service, Baltimore, Md.
- R. L. Robinson*
- R. P. Breaux
- R. S. Lloyd

U. S. Veterans Bureau, Washington, D. C.
- R. H. Archer*
- Walter W. Marr

Illinois: Chicago
- R. E. Blackwell*
- Eugene Bodmer, Jr.
- O. H. Moldal
- Arne F. Romnes
- L. D. Sayre
- Dale Snyder
- Stanley D. Tylman*

2. Volland, R. H., and Paffenbarger, G. C.: Cast Gold Inlay Technic as Worked Out in Cooperative Research at National Bureau of Standards and Applied by Group of Practicing Dentists, J.A.D.A., 19:185-205 (Feb.) 1932.

Willis Bray
C. W. Buckman
Victor Nylander
Iowa: Ames
Fred Waters*
Cedar Rapids
John Scholten*
H. E. Hansen
Dubuque
H. J. Altfillisch*
Max Kadesky
C. G. Sanner
H. M. Willets
Iowa City
R. H. Volland*
C. Burkhardt
G. S. Easton

Maryland: Baltimore
Harry Latcham*
Ethelbert Lovett
John H. Michael
M. B. Mott
Massachusetts: Boston
A. M. Maloney*
R. J. Nagle
R. B. Smith
Michigan: Detroit
Group 1
P. C. Lowery*
R. L. Donaldson
C. H. Jamison
Group 2
William A. Haidle*
W. S. Anderson

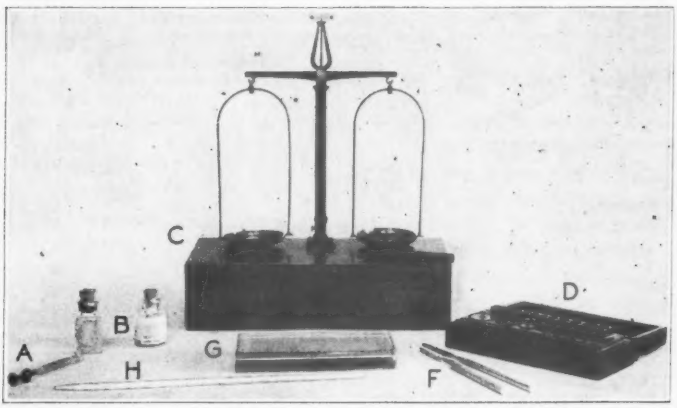

Fig. 1.—Equipment needed for Experiment 1. *A*, hypodermic syringe; *B*, cement; *C*, scales; *D*, weights; *F*, spatula; *G*, slab; *H*, thermometer.

E. Thoen
F. B. Whinery
Southwestern Iowa District Study Club
H. D. Coy*
Frank Hemphill
F. W. Schaefer
C. H. Stewart
C. E. Woodbury
Louisiana: New Orleans
Prescott Smith*
S. C. Almen
E. J. Genre
W. O. Coggin

A. J. Brake
G. R. Brooks
V. C. Piazza
T. E. Thompson
Minnesota: Minneapolis
C. E. Rudolph*
G. C. Bratager
Dorothea F. Radusch
George W. Reynolds
Robert T. Thompson
Missouri: Kansas City
E. M. Hall*
C. W. Sawyer

W. C. Schull
St. Louis
Ewing P. Brady*
E. Elsner
Ruth Martin
E. E. Shepard
E. L. Mayer*
A. V. Bauer
E. C. Bollwerk
K. E. Ehrlich
S. H. Herdlein
V. A. Kemmey
F. A. Strake
Nebraska: Omaha
Walter Sorenson*
F. D. Carman
W. A. Cotton
Frank Gough
Arthur M. Hunter
E. A. Smith
J. M. Wisan
Ohio: Toledo
Toledo Study Club: Group I
J. W. Hartshorn*
W. H. Hisey
J. W. Travis
J. J. Welker
Group II
W. R. Prickman*
W. J. Dierks
W. S. Graves
R. H. Vollmayer

TABLE 2.—RELATIVE IMPORTANCE OF PHYSICAL PROPERTIES OF ZINC PHOSPHATE CEMENTS*

Physical Property	Choices of Cooperators				
	1st	2nd	3rd	4th	5th
Dimensional change on setting	19	18	5	8	6
Solubility	18	22	10	9	8
Adhesion	16	13	13	11	6
Crushing strength	14	11	13	6	9
Fineness	8	6	10	10	7
Acidity of mix	8	5	5	3	5
Permeability	7	3	10	4	9
Setting time	5	6	8	4	7
Hydraulicity	3	1	7	4	9
Density of cement	2	6	..	12	3
Temperature rise on setting	2	4	9	9	3
Hardness	1	4	..	4	12
Plasticity	1	2	4	10	3

*Selection by the cooperating group of dentists.

Thomas A. Gardner
S. J. Honsa
L. J. Hughes
E. J. La Porte
H. A. Merchant
L. E. Myers
B. B. O'Meara
F. J. Viner
New York
New York City
William H. Crawford*
Alfred Walker*
Bernard Clug
Columbus
Alden J. Bush*
R. M. Appleman
Frank Starr
C. W. Strosnider
Pennsylvania: Pittsburgh
W. L. Fickes*
D. L. Black
D. R. McMonigle
V. A. Westin
Tarentum
A. J. Copeland*
N. J. Gestner

E. W. Heinle
Philadelphia
A. B. Gabel*
J. A. Eberly, Jr.
J. C. Entrikin
N. R. Haig
M. T. Siegel
Texas: Fort Worth
W. O. Talbot*
C. H. Lawrence
W. F. Slaughter
B. B. Welden
Houston
F. C. Elliot*
D. A. Hagerman
Glenn S. Morris
Utah: Salt Lake City
H. G. Holbrook*
W. L. Nielson
S. K. Robbins
Virginia: Richmond
Webb B. Gurley*
S. F. Bradel
A. O. James
Washington: Seattle
C. T. Fleetwood*
O. A. Anderson
Wisconsin: Milwaukee
George Wilson*
W. J. Benson
William Hopkinson
J. P. Justin
E. H. Knittel
E. E. Kraus
Otto Krause
J. M. Schlick

QUESTIONNAIRE

Certain information was desired from the dental profession that could best be obtained by questionnaires. It was thought that by learning which cements were the most popular from the clinical standpoint, which properties of the cement the dentist considered to be of most importance and what mixing technics were being used, a satisfactory specification might be formulated for these cements. Accordingly, the following questionnaire was sent to all members of the cooperating group:

QUESTIONNAIRE
FROM
THE AMERICAN DENTAL ASSOCIATION
RESEARCH FELLOWSHIP
AT THE
NATIONAL BUREAU OF STANDARDS

Name of Cooperator_____

Question 1. What brand of cement are you now using?_____

Question 2. Why are you using this particular brand? (mixes smoothly, satisfactory clinically, sets rapidly, sets slowly, adhesive, fine grained, strong, insoluble, no expansion, no contraction, hydraulic, color, price.) Underscore reasons.

Other reasons:_____

Question 3. Have you ever attempted to make comparative tests on cements? If so, what were they?_____

Question 4. Is your mixing technic standardized or reproducible? If so give all of the information on it that you can, including the amount of powder and liquid used,_____the temperature of the slab_____, time of mix

_____

Question 5. What complaints have you in regard to the cement you are now using, or have recently used?

Question 6. What properties do you think are most important in a cement of this type? List the properties in the order of their importance by placing numbers before them: Crushing strength, hydraulicity, fineness of powder, acidity of completed mix, solubility, color, time of set, change in dimension on setting, adhesiveness, temperature rise on setting, permeability, plasticity, density of powder, density of mixed cement, hardness, translucency, and any other properties which you think important._____

Question 7. What cements (which you have used) do you consider unsatisfactory?_____

What are the objections?_____

Other comments.

If the readers of this paper would copy this questionnaire, fill it out as applying to the silicious type of dental cement, and return it to the American Dental Association Research Fellowship, National Bureau of Standards, Washington, D. C., it would be of considerable assistance to the research workers who are now investigating the silicate cements.

The replies to Question 1 in the questionnaire are listed in Table 1.

The few replies to Questions 2, 3, 4, 5 and 7 were not specific and therefore cannot be readily tabulated.

Question 2. Most of the dentists were using a particular brand of cement because it was satisfactory clinically, was used in the school clinic or had been recommended by fellow practitioners.

Question 3. Comparative laboratory or clinical tests on different brands of ement had not been made except in certain instances where simple dye penetration and clinical observance tests were performed.

Question 4. The mixing technics used followed those of the manufacturers in most instances and were not sufficiently standardized to be reproducible.

Question 5. Complaints about slow setting time, coarseness of powder, variation in setting time with color of powder and the unstableness of the cement liquids were the typical replies.

The replies to Question 6 (Table 2) were very interesting, since they reflect the training and viewpoint of the practitioner.

Only a very few of the cooperators replied to Question 7. The objections were practically the same as those expressed in answering Question 5.

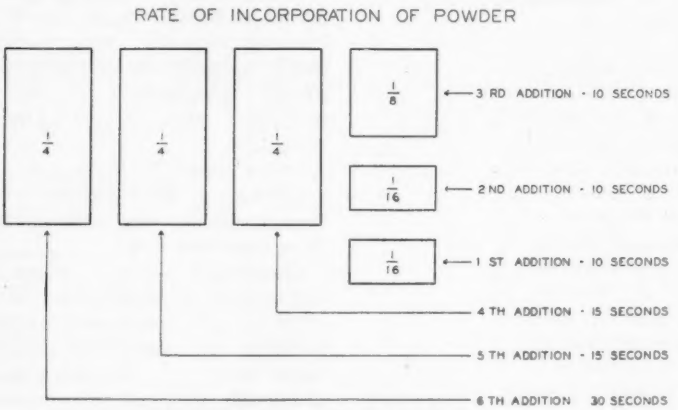

Fig. 2.—Rate of incorporation of powder.

EXPERIMENTAL WORK

The fifteen simple laboratory experiments submitted to cooperating dentists were formulated to demonstrate that the zinc phosphate cements should possess certain properties and that certain brands appear to be more suitable than others.

They are presented here so that any member of the profession can perform these experiments in his own laboratory with cements of his own choosing.

Experiment 1: Standardizing the Mixing Technic.—Since different brands of cements are to be compared, it is necessary that they be treated in a similar manner. This requires that the mixing procedure be uniform and reproducible.

Read carefully the mixing directions which accompany the packages of cement. In almost all cases, they are neither adequate nor accurate. After you have standardized your own technic, criticize the manufacturer's directions, pointing out their good and bad features.

TABLE 3.—COOPERATORS' RESULTS ON EXPERIMENT 1

Brand of Cement	Number of Mixes Reported	Amounts* of Powder Used in 0.5 C.c. of Liquid		
		Maximum Grams	Minimum Grams	Average Grams
Ames	103	1.62	0.53	1.05
Caulk	107	1.86	0.49	1.11
Fleck	102	1.86	0.43	1.24
Garhart	24	1.50	0.75	1.07
Harvard	19	1.34	0.88	1.05
Smith	28	1.54	0.87	1.07
Stratford-Cookson	21	1.27	0.81	1.09
S. S. White	128	1.88	0.62	1.21

*These values for the 0.5 c.c. mix were obtained by multiplying the values reported by the cooperators on the 0.4 c.c. mix by 1.25, making them correspond with the 0.5 c.c. mix used in our laboratory experiments.

Figure 1 shows the equipment needed for this experiment.

1. Weigh out 1.5 gm. (23.0 grains) samples of each powder and place in gelatine capsules (Size 00).

2. Note room temperature. If this is between 65 and 75 F. (18.5-24 C.), the temperature is satisfactory and no other precautions need be taken except to wash the used slabs in water at about the same temperature. If the room temperature is higher or lower, chill or heat the slab to the correct temperature by immersing in water at the desired temperature for five minutes.

3. Dry the slab quickly and notice whether water condenses on the surface. If so, the temperature of the slab is below the dew point and it must be used at a higher temperature.

TABLE 4.—TABULATION OF COOPERATORS' RESULTS ON EXPERIMENT 1-A

Cooperative Group	Number of Mixes Reported	Grams of Powder Used in 0.5 C.c. of Liquid		
		Maximum	Minimum	Average
1	10	1.65	1.26	1.43
2	10	1.72	1.39	1.53
3	10	1.82	1.30	1.58
4	6	1.40	1.20	1.30
5	10	1.62	1.30	1.45
6	10	1.75	1.30	1.57
7	10	1.69	1.49	1.57
8	10	1.49	1.23	1.35
9	10	1.82	1.10	1.54
10	10	1.43	1.00	1.21
11	10	1.23	1.12	1.18
12	9	2.00	1.18	1.53
13	10	1.26	0.98	1.16
14	10	1.75	1.46	1.61
15	10	1.30	1.04	1.10
16	10	1.69	1.23	1.42
17	10	1.23	1.17	1.20
Average for all mixes				1.40

4. Deposit the weighed cement powder on one end of the slab.

5. Insert the glass hypodermic syringe (capacity 0.5 c.c.) in the cement liquid and withdraw 0.4 c.c. of the liquid. Deposit near the opposite end of the slab.

6. Note the time and begin to mix, using your usual technic. Mix until you have the consistency which you normally use for setting inlays, crowns or bridges.

If a different consistency is used for inlays from that used for bridges, determine the inlay consistency on all cements. Select one cement for bridge consistency determination if desired.

7. Weigh the unused portion of the powder and subtract from the original weight. This will give the amount of powder used with 0.4 c.c. of liquid.

8. Repeat this experiment on each cement.

9. Repeat it twice or more on your own favorite brand to see how closely you duplicate your results. Determine the amount of powder used for each mix.

10. These then shall be the proportions which must be used in all of the following experiments unless otherwise specified.

11. Figure 2 shows the rate of powder incorporation which was used in tests at the National Bureau of Standards.

12. Outline the approximate method which you use.

13. An outline form of the data sheet is shown in Figure 3.

It was thought that the results of this experiment would provide sufficient data for guidance in arriving at a proper powder: liquid ratio for use in a specification and also give valuable data on mixing technics. The results tabulated from the returned data sheets for Experiment 1 (Table 3) showed practically the same average value for several popular brands of cement. These data did not agree with the results of accurate consistency tests made in the Bureau's dental laboratory, which showed considerable difference between different brands of cement with respect to the amount of powder which could be used with a definite quantity of liquid to produce the same consistency of mixed but unset cement. The data in Table 3 show that some experimenters used from three to four times as much powder in the same quantity of liquid as others did. Consequently, several weeks

Data _____ Standard Mixing Technic _____

Brand of Cement		Amount of Powder Used With 0.4 cc of Liquid*	Time of Mix in Minutes and Seconds	Temperature	
				Room °F	Slab °F
1.	(Your favorite brand)				
2.	"				
3.	"				
4.					

*State weight in grains (gr.) or in grams (g).

The rate of the addition of the powder is an important item in mixing cements of this type. Outline your method here.

Fig. 3.—Data sheet for Experiment 1.

TABLE 5.—TABULATION OF COOPERATORS' DATA ON EXPERIMENTS 2 AND 3

TABLE 5.—TABULATION OF COOPERATORS' DATA ON EXPERIMENTS 2 AND 3

Brand of Cement	Setting Time							Disintegration				
	Room Temperature				Mouth Temperature							
	Number of Mixes Reported	Minimum	Maximum	Average	Number of Mixes Reported	Minimum	Maximum	Average	Number of Dentists Reporting	A*	B	C	D
		Minutes				Minutes				Percentage†			
Ames	118	4	70	15	110	3	40	9	59	2	2	19	78
Caulk	113	4	120	15	106	3	20	7	54	33	22	27	8
Fleck	130	5	23	10	136	3	9	5	70	41	39	13	7
Garhart	28	5	41	14	26	3	21	8	14	14	7	64	14
Harvard	38	6	62	26	37	5	24	14	18	0	28	67	6
Smith	48	5	42	13	52	4	14	7	23	22	22	39	17
Stratford-Cookson	32	4	27	14	32	3	14	7	16	38	50	12	0
S. S. White	155	4	19	8	156	2	26	6	80	55	36	8	1

*A being relatively the least disintegration.

†Computed on number of replies received on each cement, each value being rounded off to the nearest percentage.

later, another Experiment (1-A) was forwarded to several of the groups who had completed all of the experiments. The materials used in this experiment were furnished by the Research Commission and the same brand, color and batch were used because different batches and colors of the same brand of cement often showed wide variation in physical properties. Thus, all of the variables except the dentist's judgment and mixing technic were eliminated. S. S. White zinc phosphate cement was used in this experiment.

Experiment 1-A.—The returned data sheets for Experiment 1 show great variation in consistency of mix among individual cooperators. The reasons for these enormous variations are not evident. They may have resulted from lack of uniformity in material, exposure of the liquid, differences in technic or some one of a number of variables. Your assistance is desired in an effort to locate the difficulty.

Under separate cover, you will receive an experimental cement and liquid. This material is believed to be uniform.

Please call together your group, or as many of the group as you can conveniently assemble. Open the materials and proceed to make mixes of what you regard as proper consistency for complicated mesioclusodistal inlay, crown or other operations of average difficulty.

Have different men make mixes while the others observe. It would be appreciated if you would report at least ten mixes. Have each operator make at least two mixes. There is sufficient material for five operators to make one preliminary mix before making two mixes for record.

Instruct each man to make the mix to suit his own idea of proper consistency. Do not attempt to influence the operator and do not attempt to reduce your re-

ports to a uniform or standard value. The operators need not be named, but it is necessary to locate the section of the country.

The following schedule will enable the group to proceed uniformly:

1. Use a heavy glass slab at a temperature near 70 F. If moisture condenses on the slab in appreciable amounts, raise the temperature by 5 degree intervals until condensation stops.

2. Weigh out 2 gm. or 30 grains of powder and transfer to the slab.

3. Place 0.5 c.c. of liquid on the slab. (This is 25 per cent more than you used previously.)

4. Mix in your customary manner. Record the time taken to make the mix. Advise the operator that the mix should be of a consistency which will allow sufficient time to insert the inlay or appliance.

5. Ask the operator to estimate the maximum time that he would consume in seating a complicated casting such as a crown, bridge or multisurfaced inlay after completing the mix.

6. Report your findings on the inclosed data sheet. (Figure 4.)

The powder: liquid ratio data (on S. S. White Cement, which does not show any unusual differences among batches, but was chosen for this experiment because more data were available on it than on the other cements at the time the experiments were written) for Experiment 1-A (Table 4) shows a higher average value (1.40 gm.) than the value reported (1.21 gm.) in Experiment 1 (Table 3). The reason for the higher value in the later Experiment (1-A) is not known, but a possible explanation is the uniformity of the material supplied. About 25 per cent more powder could be in-

Consistency of Mix on Experimental Cement

Date _____

Name of Contact Man:

_____

Weather Condition:
Rainy ____
Damp ____
Average ____
Dry ____

(1) Experimenter	Grains or Grams of Powder Used in 0.5 cc of Liquid	Time of Mix in Minutes and Seconds	Estimated Time Required to Seat Appliances after Completion of the Mix in Minutes and Seconds	Temperature	
				Room °F	Slab °F
A-First Trial					
A-Second Trial					
B-First Trial					
B-Second Trial					
C-First Trial					
C-Second Trial					
D-First Trial					
D-Second Trial					
E-First Trial					
E-Second Trial					

(1) If five experimenters are not available have those present complete ten mixes.

Fig. 4.—Data sheet for Experiment 1-A.

TABLE 6.—TABULATION OF COOPERATORS' DATA ON EXPERIMENT 4

Brand of Cement	Number of Dentists Reporting	Effect of Varying Powder:Liquid Ratio on Setting Time									Effect of Varying Powder:Liquid Ratio on Disintegration								
		Normal Mix			Reduced (Thin) Mix*			Increased (Thick) Mix†			Number of Dentists Reporting								
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Least Disintegration			Medium Disintegration			Most Disintegration		
		Setting Time Minutes			Setting Time Minutes			Setting Time Minutes			Thin Mix*	Normal Mix	Thick Mix†	Thin Mix*	Normal Mix	Thick Mix†	Thin Mix*	Normal Mix	Thick Mix†
Ames	13	6	25	13	13	240	75	3	13	7	0	3	8	3	5	3	8	3	0
Caulk	16	2	21	9	8	60	25	2	6	5	1	6	9	0	9	5	14	0	1
Fleck	16	5	13	8	7	42	15	2	12	6	3	6	6	1	6	6	9	1	1
Harvard	1	..	..	10	..	..	30	..	..	8	..	..	1	..	1	..	1	..	..
Smith	1	..	..	6	..	..	27	..	..	4	..	..	1	..	1	..	1	..	..
Stratford-Cookson	1	..	..	16	..	..	46	..	..	7	..	1	..	..	..	1	1	..	..
White	25	3	15	8	6	50	15	2	9	5	3	9	16	8	11	6	13	4	2

*Five grains or 0.3 gm. less powder than used in normal mix.
†Five grains or 0.3 gm. more powder than used in normal mix.

corporated in cement 1-A than in some other batches of the same brand, to obtain the same consistency. The average deviation from the average values were approximately the same for each experiment (±0.20 gm. for Experiment 1 and ±0.18 gm. for Experiment 1-A). This seems to indicate that the cooperating dentists had approximately the same variations or spread of values in both experiments.

The average of the consistencies which the cooperators reported in Experiment 1-A would produce a disk having a diameter of 30±1 mm. (Consistency test.[3]) This consistency requirement was incorporated into the specification. Thus, the specification tests must be made on specimens produced from mixes of a consistency which is representative of that actually used by practicing dentists.

The average value for the time of mixing reported in Experiment 1 was ninety-four seconds. The extremes were thirty-five and 240 seconds. The values for mixing time reported in Experiment 1-A ranged from thirty-four to 160 seconds, with an average value of ninety-four seconds. The average of the values given under the column headed "Estimated Time Required to Seat Appliances After Completion of Mix" was sixty-one seconds. (Fig. 4.) The maximum and minimum values were 120 and twenty seconds, respectively.

Experiment 2: Setting Time at Room Temperature and Disintegration in Distilled Water.—The setting time of the cement, which is a very important property, can, in a large measure, be controlled by the individual operator. This and subsequent experiments will demonstrate ways of controlling the time of setting.

1. Cut from the full length of a celluloid strip a piece approximately three-sixteenths inch wide. Roll this into a cylinder approximately three-eighths inch in diameter. Fasten the free end of the celluloid strip with a strip of gummed paper or by moistening the end of the strip with a drop of acetone. This will be the mold for the cement specimen.

2. Make a mix of your favorite cement, using the standardized technic which was used in Experiment 1 and the same ratio of powder to liquid as determined for the particular brand of cement.

Name of Cooperator_____

Brand of Cement	(1) Setting Time in Minutes				Disintegration (Relative) Rated A(2), B, C, or D	
	Room Temperature		Mouth Temperature			
	Trial 1	Trial 2	Trial 1	Trial 2	Room Temperature	Mouth Temperature

(1) Record to the nearest minute.

(2) A being least disintegration.

Fig. 5.—Data sheet for Experiments 2 and 3.

3. Footnote 1, second reference.

TABLE 7.—TABULATION OF COOPERATORS' DATA ON EXPERIMENT 5

Brand of Cement	Effect of Doubling Mixing Time on Setting Time								
	Setting Time at Room Temperature					Setting Time at Mouth Temperature			
	Minimum	Maximum	Average	Number of Mixes Reported	Mixing Time	Minimum	Maximum	Average	Number of Mixes Reported
	Minutes					Minutes			
Ames	4	70	15	118	Normal	3	40	9	59
	11	37	23	18	Twice normal	5	32	15	18
Caulk	4	120	15	113	Normal	3	20	7	54
	6	36	14	30	Twice normal	5	12	8	30
Fleck	5	23	10	130	Normal	3	9	5	70
	5	21	10	30	Twice normal	4	13	6	30
S. S. White	4	19	8	150	Normal	2	26	6	80
	6	36	14	42	Twice normal	3	13	18	42

3. Place the celluloid cylinder on a glass surface and fill it approximately level with the mixed cement.

4. Touch the surface of the cement with the large Gillmore needle[1] (made by the American Instrument Company, Washington, D. C.) weighing 1 pound and having an end one-twenty-fourth inch in diameter, held vertically. If the cement appears to offer some resistance, allow the full weight of the needle to rest upon the cement for five seconds. As soon as a trial with the needle fails to make a perceptible circle on the cement, consider it set. Record on the data sheet (Fig. 5) under "Setting Time, Room Temperature, Trial 1 (to the nearest minute), as the setting time, the number of minutes elapsed since starting the mix.

5. Immediately after recording the setting time, remove the celluloid strip and drop the pellet of cement into a small vial or bottle containing 10 c.c. (one-third fluid ounce) of distilled water.

6. Carry out all the steps of the experiment for each brand of cement. Drop the pellet of each brand into a separate vial. Label and date the bottles.

7. Repeat the entire experiment for each brand of cement and record the setting times under "Trial 2" on the data

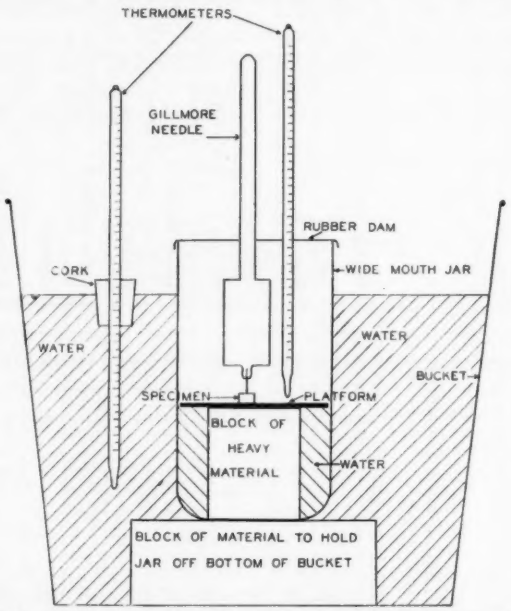

Fig. 6.—Apparatus used in determining the setting time of dental cements under oral conditions. The mouth of the jar is to be covered with a piece of rubber dam through which holes are punched for insertion of a thermometer and the Gillmore needle. It will be necessary to cut a large hole (arranged with a flap for closing) for the purpose of introducing specimens and for observations. The water in the bucket is to be kept hot enough to make the air in the jar 99±1 F. The air in the jar will become saturated. Thus the conditions of temperature and humidity will simulate those in the mouth.

sheet for Experiments 2 and 3. (Fig. 5.)

Experiment 3: Setting Time at Mouth Temperature and Humidity.—1. Prepare an apparatus similar to that illustrated in Figure 6.

2. Prepare specimens of each cement, as in Experiment 2, but vary the procedure as follows: Immediately after filling the celluloid cylinder with cement, pick up the piece of glass with the cylinder on it and set it on the platform in the jar. Keep the flap closed except when inserting specimens or making observations.

3. Record, on the data sheet (Fig. 5) under "Setting Time, Mouth Temperature, Trial 1," the setting time for each cement. Repeat the test for each brand and record the findings under "Trial 2."

4. In every case, drop the pellets into bottles of water as was done in Experiment 2.

5. One week after placing the pellets, made in Experiment 3, in the vials, shake each vial vigorously and observe any cloudiness present in the water. Grade the cements according to the evidence of relative disintegration, rating the one showing the least cloudiness as "A." These vials and other vials containing specimens of cement prepared in later experiments should be kept for further observations on disintegration.

The results of the cooperators' findings for Experiments 2 and 3 are tabulated in Table 5.

Experiment 4: Effect of Powder: Liquid Ratio on the Setting Time and on

TABLE 8.—TABULATION OF COOPERATORS' DATA ON EXPERIMENT 6

Brand of Cement	Addition of Powder in Eight Equal Portions	Number of Mixes Reported	Setting Time		
			Minimum	Maximum	Average
			Minutes		
Ames	At 10 second intervals	18	9	22	14
	At 5 second intervals	18	5	17	10
Caulk	At 10 second intervals	30	4	19	8
	At 5 second intervals	30	3	18	6
Fleck	At 10 second intervals	30	4	10	7
	At 5 second intervals	30	3	12	6
Garhart	At 10 second intervals	2	..	..	4
	At 5 second intervals	2	..	..	4
Harvard	At 10 second intervals	2	..	..	7
	At 5 second intervals	2	..	..	7
Smith	At 10 second intervals	4	6	9	8
	At 5 second intervals	4	4	9	6
Stratford-Cookson	At 10 second intervals	2	..	..	8
	At 5 second intervals	2	..	..	5
S. S. White	At 10 second intervals	42	3	16	8
	At 5 second intervals	42	3	18	7

Disintegration.—In Experiments 2 and 3, the setting time and disintegration were determined for the standardized ratio of powder to liquid for each brand of cement. The present experiment is for the purpose of determining what effect, if any, is produced by varying the proportion of powder to liquid.

1. Make a specimen, as in Experiment 2, of your favorite cement, using the standardized technic and the standard ratio of powder to liquid. Record the setting time after "Powder Ratio to Liquid—Normal" on the data sheet (Fig. 7). Place the specimen pellet in a vial of distilled water and label and date as in Experiment 2.

2. Next, make a specimen, of the same brand, using the same mixing technic, but using 5 grains or 0.3 gm. less powder than the normal amount. Record the setting time after "Powder Ratio to Liquid—Reduced" on the data sheet (Fig. 7). Place the pellet in a separate vial of water, label and date.

3. Finally, make a specimen of the same brand using 5 grains or 0.3 gm. more powder than the normal amount. Record the setting time after "Powder Ratio to Liquid—Increased" on the data sheet (Fig. 7) and place the pellet in another vial.

4. Record the actual weight of powder used in each mix in the spaces in the column "Actual weight of powder used."

5. One week after placing the pellets

THE EFFECT OF POWDER-LIQUID RATIO ON THE SETTING TIME AND ON DISINTEGRATION

Brand of cement _____ (Fill in name of brand)

Powder Ratio to Liquid	Actual Weight of Powder Used	Setting Time in Minutes	Disintegration (Relative) A* - B - C
Normal			
Reduced (Thin)ø			
Increased (Thick)x			

* A being least disintegration

ø 5 grains or 0.3 grams less powder than used in normal mix

x 5 grains or 0.3 grams more powder than used in normal mix.

Fig. 7.—Data sheet for Experiment 4.

THE EFFECT OF MIXING TIME ON SETTING TIME

Brand of Cement _____ (Fill in name of brand)

Temperature	Mixing Time in Minutes & Seconds	Setting Time in Minutes
Room, (Specimen 1)		
" (Specimen 2)		
Mouth, (Specimen 1)		
" (Specimen 2)		

Fig. 8.—Data sheet for Experiment 5.

in the vials, observe the disintegration as in Experiment 3. Rate the three specimens A, B or C, A indicating the least disintegration as judged by the least cloudiness in the water. Record the ratings in the "Disintegration" column on the data sheet (Fig. 7).

The results of the cooperators' findings for Experiment 4 are tabulated in Table 6.

Experiment 5: Effect of Mixing Time on Setting Time.—1. Prepare 2 specimens, as in Experiment 2, using your favorite brand of cement and your standardized mixing technic, as worked out in Experiment 1, with the exception of doubling the mixing time. Record the setting times on the data sheet (Fig. 8).

2. Repeat the experiment with two more specimens, determining the setting times at mouth temperature and humidity, as in Experiment 3. Record the setting times (Fig. 8).

3. Compare the results with the setting times of the same brand of cement in Experiments 2 and 3.

The data of the cooperating group of dentists on Experiment 5 are given in Table 7. In addition to the data given are those from three dentists who used Garhart's, Harvard's and Smith's cements for this experiment. The reported average setting time in minutes at room and mouth temperature, respectively, for Garhart's cement was 7 and 7; for Harvard's cement 5 and 4; for Smith's cement 15 and 9.

Experiment 6: Effect of Rate of Incorporation of Powder on Setting Time.—1. Make two mixes of your favorite brand of cement, using your standardized mixing technic with the exception of adding the powder to the liquid in eight equal portions at intervals of ten seconds. Determine the setting times as in Experiment 2.

2. Repeat the experiment with two more specimens, incorporating eight equal portions of the powder at five-second intervals.

3. Record the setting times on the data sheet for Experiment 6 (Fig. 9).

4. Compare the setting times with the

TABLE 9.—TABULATION OF COOPERATORS' DATA ON EXPERIMENT 7

Brand of Cement	Number of Dentists Reporting	Setting Time When Partially Neutralized Liquid Was Used			Setting Time When Normal Liquid Was Used		
		Experiment 7			Experiment 2*		
		Minimum	Maximum	Average	Minimum	Maximum	Average
		Minutes			Minutes		
Ames	8	11	19	14	8	70	24
Caulk	13	5	14	10	4	19	12
Fleck	12	6	14	9	5	18	10
Garhart	1	..	..	7	..	..	6
Harvard	1	..	..	17	..	..	11
Smith	2	8	14	11	12	16	13
Stratford-Cookson	3	8	20	9	4	17	12
S. S. White	20	6	19	9	5	16	10

*These data were taken from cooperators who completed Experiment 7.

setting times of the same brand of cement in Experiment 2.

The results of the cooperators' findings for Experiment 6 are presented in Table 8.

Experiment 7: Effect of Partial Neutralization of the Cement Liquid on Setting Time.—1. Make a mix of your favorite brand of cement, but depart from your standardized technic as follows: Incorporate, at first, a very small portion of the powder (approximately one-sixty-fourth of the amount for the mix). Spatulate for thirty seconds. Wait one minute before continuing the mix. Determine the setting time as in Experiment 2. Record the result on the data sheet for Experiment 7 (Fig. 10).

The results of the cooperators' findings on Experiment 7 are presented in Table 9.

Experiment 8: Effect of Temperature on Setting Time.—1. Make a mix of your favorite cement using your standard technic, as worked out in Experiment 1, with the exception of having the slab at 85 F. (29.5 C.). Allow the mix to set on the slab. Record the setting time on the data sheet (Fig. 11).

2. Make a second mix with the slab at the same temperature and prepare a specimen, as in Experiment 3, and place

THE EFFECT OF RATE OF INCORPORATION OF POWDER ON SETTING TIME

Brand of Cement _____ (Fill in name of brand)

Powder added in 8 equal portions	Setting Time in Minutes
At 10 second intervals, (Specimen 1)	
" " " " (Specimen 2)	
At 5 second intervals, (Specimen 1)	
" " " " (Specimen 2)	

Fig. 9.—Data sheet for Experiment 6.

THE EFFECT OF PARTIAL NEUTRALIZATION OF THE CEMENT LIQUID ON SETTING TIME

Brand of Cement _____ (Fill in name of brand) Setting Time _____ (in minutes)

Fig. 10.—Data sheet for Experiment 7.

THE EFFECT OF TEMPERATURE ON SETTING TIME

Brand of Cement _____ (Fill in name of brand)

Temperature of the slab	Setting Conditions	Setting Time in Minutes
85 F	Allowed to set on the slab	
85 F	Mouth temp. and humidity apparatus	
98.6 F	Allowed to set on the slab	
98.6 F	Mouth temp. and humidity apparatus	

Fig. 11.—Data sheet for Experiment 8.

it in the mouth temperature and humidity apparatus used in that experiment. Record the setting time on the data sheet (Fig. 11).

3. Make a mix and allow the cement to set on the slab, as indicated above, but with the slab at a temperature of 98.6 F. (37 C.). Record the setting time on the data sheet (Fig. 11).

4. Make a mix and prepare a specimen as indicated above, but with the slab at a temperature of 98.6 F. (37 C.). Place the specimen in the mouth temperature and humidity apparatus and record the setting time on the data sheet (Fig. 11).

5. Notice the difference in the smoothness of the mixes and the difference in the setting times.

The results of the cooperators' findings on Experiment 8 are presented in Table 10.

Experiment 9: Disintegration in Natural and Artificial Saliva.—1. Make specimens, as in Experiment 2, of all brands of cement, using your standard technic.

2. Immerse the specimens in (a) your own saliva, preserved by the addition of a few drops of chloroform (10 c.c.) or (b) artificial saliva, $p_H 7$[4] (10 c.c.).

3. Allow the specimens to rest undisturbed for two weeks, then note the sediment on the bottom of the bottles. In time, mucin will be precipitated from natural saliva, but it should be possible to distinguish this from particles of the disintegrated cement.

4. Fill in the data sheet for Experiment 9 (Fig. 12).

5. There are many possibilities in extending this solubility experiment. Various mouth washes, such as sodium perborate and hexylresorcinol can be used as immersion liquids and the disintegration of the cements noted.

The tabulation of the cooperators' replies on Experiment 9 are given in Table 11.

Experiment 10: Hydraulic Property.—

TABLE 10.—TABULATION OF COOPERATORS' DATA ON EXPERIMENT 8

Brand of Cement	Number of Dentists Reporting	Average Setting Time			
		Slab Temperature			
		85 F.		98.6 F.	
		Time Allowed to Set on Slab	Set in Temperature and Humidity Apparatus (Fig. 6)	Time Allowed to Set on Slab	Set in Temperature and Humidity Apparatus (Fig. 6)
		Minutes			
Ames	9	16	11	14	11
Caulk	13	11	6	7	6
Fleck	16	9	6	6	5
Garhart	1	5	4	4	3
Harvard	1	7	7	4	4
Smith	2	9	7	8	7
Stratford-Cookson	3	11	6	8	5
S. S. White	21	8	6	5	5

4. Sodium chloride, 0.036 gm.; potassium chloride, 0.153 gm.; calcium chloride (anhydrous), 0.056 gm.; disodium phosphate, 0.210 gm.; water, 2.0 liters; brought to $p_H 7$ with dilute hydrochloric acid.

The term hydraulic has been loosely used in cement advertising and in the literature. Such terms as "a thoroughly hydraulic cement" and "warranted hydraulic" are frequently seen. If a cement were actually hydraulic, it would harden under water and become impervious to its action. Since these cements have been termed hydraulic, the assumption has been that saliva may be allowed, or, in fact, should be allowed, to flow over the cement before it has set. Despite this popular idea, cements of this type need to be protected from saliva until setting has taken place; otherwise, they will be damaged. Phosphoric acid has a great affinity for water. If cement is placed in water before the initial set has taken place some of the acid may be leached out by the water; which causes the cement to be very porous and chalky. This will be shown in the ensuing experiment.

DISINTEGRATION IN NATURAL AND ARTIFICIAL SALIVA

Question 1. Are any of the cements free from disintegration in either medium? _____

Question 2. Do some cements seem to disintegrate more than others? _____

Question 3. How do they compare with those immersed in distilled water (Experiments Nos. 2 and 3)? (The length of time during which the different specimens are immersed affects this comparison.) _____

Question 4. Are any cements, in your opinion, free from disintegration? _____

Question 5. Which cements seem to resist the breaking down? _____

Question 6. Which do not? _____

Fig. 12.—Data sheet for Experiment 9.

THE HYDRAULIC PROPERTY

Question 1. Which portion sets first? _____

Question 2. Setting time (in minutes) _____ In water _____ In air

Question 3. Is the water turbid? _____

Question 4. Notice the surface. Which portion has a clear smooth surface? _____

Fig. 13.—Data sheet for Experiment 10.

1. Make a mix of any one of the cements and divide the mix into two equal portions.

2. Scrape up one portion on the spatula and allow it to drop into a glass about one-fourth full of water at room temperature.

3. Drop the other portion into a dry glass.

4. Test each portion for setting time, using the Gillmore needle, as in Experiment 2.

5. Fill in the data sheet for Experiment 10 (Fig. 13).

6. After both portions of the cement have set, break the specimens between the fingers and notice the great difference in quality.

The tabulation of the cooperators' replies on Experiment 9 is given in Table 12.

Experiment 11: Permeability.—1. Pre-

pare standard specimens of all brands of cement, as in Experiment 2.

2. Allow these specimens to set, then remove the celluloid and drop the specimens into small bottles of red ink.

3. Prepare another set of specimens, but allow the cement to set only sufficiently to permit the removal of the celluloid. When the celluloid has been removed, drop the specimens into water at once. One-half hour later, take the specimens out of the water and drop them into bottles of red ink.

4. After twenty-four hours, remove the specimens and wipe off the excess ink. Plane one end of each cylinder smooth, using fine sand paper and cutting away enough of the cement to show only the ink that has penetrated from the side of the cylinder.

5. Note how far the ink has penetrated the different specimens. Measure the depths of penetration and fill in the data sheet for Experiment 11 (Fig. 14).

6. Varnish the specimens with cavity varnish or sandarac and mount them on a cardboard. This will serve as an exhibit for a clinic.

The reports of the cooperators on Ex-

TABLE 11.—TABULATION OF COOPERATORS' REPLIES ON EXPERIMENT 9

Question*	Number of Dentists Reporting	
	Yes	No
1	4	48
2	53	0
4	3	43
	Disintegration	
	More	Less	Same
3	14	12	24

Brand of Cement	Question 5* Number of Dentists Reporting	Question 6* Number of Dentists Reporting
Ames	5	31
Caulk	20	6
Fleck	29	7
Garhart	0	12
Harvard	7	2
Smith	2	5
Stratford-Cookson	8	2
S. S. White	36	2

*Fig. 12.

TABLE 12.—TABULATION OF COOPERATORS' REPLIES ON EXPERIMENT 10

Question*	Air	Water
	Number of Dentists Reporting	
1	29	9
2	Minutes 19†	Minutes 23*
4	28	0
	Turbidity of Water	
	Yes	No
3	32	8

*Fig. 13.
†Average time of setting.

TABLE 13.—TABULATION OF COOPERATORS' DATA ON EXPERIMENT 12

Brand of Cement	Shrinkage			
	A*	B	C	D†
Ames	15	8	..	7
Caulk	3	5	7	11
Fleck	9	9	13	10
Garhart	6	2	..	..
Harvard	2	2	2	5
Smith	2	..	1	1
Stratford-Cookson	2	2	6	1
S. S. White	7	10	8	20

*Least shrinkage.
†Most shrinkage.

periment 11 showed that, in seventy-two instances, the depth of penetration of the dye was greater when the test specimens were immersed in water (prior to complete setting) before being placed in the dye. In twenty-eight instances, the depth of penetration was reported as less in such specimens; while, in eighty-five instances, no difference was detected in the depth of penetration of the dye between specimens subjected to the two treatments outlined in the second and third paragraphs on Experiment 11.

PERMEABILITY

Brand of Cement	Powder-Liquid Ratio	Penetration in mm	
		Specimens into ink after setting	Specimens into water before set, then into ink

Fig. 14.—Data sheet for Experiment 11.

DIMENSIONAL CHANGE ON SETTING

Brand of Cement	Powder-Liquid Ratio	Shrinkage A - B - C or D (A - least. D - most)

Fig. 15.—Data sheet for Experiment 12.

RELATIVE PARTICLE SIZE

Brand of Cement	Relative Turbidity of Liquid A - B - C or D (A - most. D - least)	Relative Fineness of Powder A - B - C or D (A - finest. D - coarsest)

Fig. 16.—Data sheet for Experiment 14.

Experiment 12: Dimensional Change on Setting.—1. Take four glass tubes (approximately one-half inch long and having a bore three-sixteenths inch in diameter), and wash them thoroughly with soap and water. Then boil them in clean dilute sulphuric acid. Rinse off thoroughly and dry them. It is important that these tubes be clean and dry.

2. Make a mix of each brand of cement, using your standard technic worked out in Experiment 1.

3. Fill the glass tubes, having set them on a glass slab.

4. Cover the top of each tube with a glass plate.

5. After the initial setting of the cement has taken place, rub the cement down flush with the glass tube using fine sandpaper. Then drop the tubes into bottles of red ink.

6. Twenty-four hours later, remove the tubes from the ink and observe the penetration of the ink between the cement and the glass tube.

7. Record the results on the data sheet for Experiment 12 (Fig. 15).

8. Seal the ends of the tube with wax or varnish and mount on a cardboard for a permanent exhibit.

This is a crude test, but it will give some indication of shrinkage. Practically all of the zinc cements shrink on setting.

The tabulation of the cooperators' results on Experiment 12 is given in Table 13.

Experiment 13: Crushing Strength.—1. Make a thin solution of paraffin in benzene and paint the inside of five black hard rubber tubes used to form cylindrical test specimens 0.50 inch high and 0.25 inch in diameter.[1] The purpose of this is to facilitate the removal of cement specimens after the tubes have been used as molds.

2. Make five specimens, all of the same brand of cement, using your standard technic, as determined in Experiment 1. Fill the black tubes in the same manner that the glass tubes were filled in Experiment 12.

3. After the initial set has taken place, drop the tubes containing the specimens into water.

4. Place a small amount of carborundum powder on a flat piece of glass. Wet the powder with water.

5. With light strokes, plane the ends of each specimen until even with the ends of the tube, drawing the tubes back and forth across the glass plate charged with the carborundum powder and water. Every few strokes, rotate the tube a quarter of a turn. You will be able to detect when the cement specimen is ground almost flush with the end of the mold by the different "feel" as the tube is drawn back and forth. Thereafter, make about twelve additional very light strokes, always rotating the tube about a quarter of a turn after each stroke. Considerable art is required in making a specimen the ends of which are absolutely square, i.e., at right angles to the long axis of the specimen. If they are not square, the crushing determinations will be low and erratic, because cement is extremely brittle, and hence will not "level off" when pressure is applied in the testing machine. If a micrometer is available, it should be used to check the parallelism of the ends of the specimens. Place the specimen between the jaws of the micrometer and observe whether light can be seen between the specimen and

TABLE 14.—TABULATION OF COOPERATORS' REPLIES ON EXPERIMENT 14

Brand of Cement	Relative Turbidity				Relative Fineness of Powder			
	Number of Choices by Cooperators							
	A (Most)	B	C	D (Least)	A (Finest)	B	C	D (Coarsest)
Ames	7	5	9	15	14	10	9	1
Caulk	3	10	4	3	11	4	4	1
Fleck	13	6	10	7	13	16	7	..
Garhart	..	1	2	12	..	..	3	10
Harvard	4	7	1	..	..	..	2	10
Smith	4	..	..	..	..	4	..	..
Stratford-Cookson	..	4	2	..	..	1	4	..
S. S. White	11	12	10	3	4	16	5	10

the jaw of the micrometer at any place.

6. After plane surfacing both ends, push the specimen out of the tube, using a cylindrical rod slightly smaller than the hole in the tube.

7. Place the specimens in a bottle of distilled water, label the bottle with the brand of cement, the date it was mixed and the name of the cooperator who mixed it.

The crushing strength determinations on the specimens from this cooperative group were made by the American Dental Research Fellowship at the National Bureau of Standards. Lack of time and personnel will not permit the fellowship to make private tests of this type. Almost any engineering school or private testing laboratory can do this type of testing. Several dental schools are also equipped to conduct such tests.

TABLE 15.—SIZE OF LARGER POWDER PARTICLES

Brand of Cement	Average Maximum Linear Dimension of Larger Particles of Powder	
	Microns*	Inch
Ames	50	0.0020
Caulk	40	0.0016
Fleck	25	0.0010
Garhart	85	0.0034
Harvard	90	0.0045
Smith	80	0.0040
Stratford-Cookson	65	0.0026
S. S. White	55	0.0022

*Reported to nearest 5 microns.

Because of the character of this test, an average value of the findings on any particular cement would mean very little. Some of the cooperating groups made specimens which had plane parallel ends and gave uniform values. The compressive strength values for the better class of specimens ranged from about 12,000 to about 16,000 pounds per square inch. Another group ranged from 4,000 to 8,000 pounds per square inch. These variations were caused by a number of conditions including the state of the cement itself, the proportion of powder to liquid, the mixing technic and the lack of parallelism of the ends of the specimens.

Experiment 14: Relative Particle Size.—1. Weigh out 1 gm. or 15 grains of the powder of each cement.

2. Place each sample in a test tube, about two-thirds full of water.

3. Stopper each tube and shake all tubes vigorously.

4. Stand the tubes upright and allow the powder to settle for thirty seconds.

5. Observe the cloudiness of the water in each tube.

6. After a minute or two, shake the tubes vigorously again and repeat the observations on turbidity. Rate the four specimens comparatively, A, B, C or D, A for the most turbidity, indicating the finest particles. Record the ratings on the data sheet for Experiment 14 (Fig. 16).

7. One minute after shaking the tubes, cautiously pour off about 90 per cent of the water. This will remove the finer particles, which are more easily kept in suspension, leaving the coarser particles.

8. Add enough water to make the tubes two-thirds full again, shake vigorously, let stand a minute and again pour off 90 per cent of the water. Repeat this decantation approximately ten times.

9. Finally, filter through filter paper and allow the powder to dry over night.

10. Shake the powder off the filter paper onto a sheet of paper.

11. Test the coarseness of each powder by taking a few particles between the teeth and by rubbing a few particles on a glass slab with a spatula. Record the relative fineness on the data sheet, using A for the finest (Fig. 16).

The tabulation of the cooperators' re-

plies on Experiment 14 are given in Table 14.

The larger particles of powder separated by water flotation were sent to the A.D.A. Research Fellowship by the cooperators for measuring. The method used in these determinations has previously been described.[1] The results are tabulated in Table 15.

Experiment 15.—During the mixing of a zinc phosphate cement, a certain amount of air is unavoidably trapped in the mix. Some of this air was present in the powder while some was incorporated in the spatulation. In making the specimens for the determination of crushing strength, you probably noticed that when the top glass plate was pressed upon the top of the hard rubber mold, it came down flush, but when the pressure was released, the plate was raised. This is caused by the compression of the minute air particles within the cement by force applied upon the top glass plate. When this force is discontinued before the cement sets, the compressed air resumes its former dimensions and lifts the top glass plate. The same phenomenon occurs in the seating of inlays, crowns, etc. By placing a mix between two glass plates and pressing it into a thin wafer, the relative amount of incorporated air can be noted by holding the glass up to a light. A magnifying glass will be very useful in this determination. This experiment shows that an inlay or bridge should be held in place until the cement sets.

COMPOSITION OF ZINC PHOSPHATE CEMENTS

Most cement powders are essentially calcined zinc oxide modified, more or less, with magnesium oxide and other oxides.[5] It seems that powders with a zinc oxide content of nearly 100 per cent do not make so satisfactory a cement as the definitely modified powders.[1]

The liquids are solutions of phosphoric acid in water, partially neutralized, or buffered, by the addition of zinc oxide or aluminum hydroxide or both. This partial neutralization helps to retard[2] the reaction between the liquid and the powder. The degree of calcination of the powder is another factor in retarding the reaction between the liquid and the powder and hence the setting time. If the liquid were not partially neutralized, the reaction between the liquid and powder would be violent, with great liberation of heat and very rapid setting, and a granular, porous mass would be the result.

If a cement liquid is exposed to the air, it will either take up water or give it off, this depending on the humidity of the atmosphere at the time. If the liquid takes up water, it usually makes a quicker setting cement, while loss of water usually results in slower setting. Therefore, the stopper should always be tightly inserted immediately after each withdrawal of liquid from the bottle. Also, the cement liquid should not be placed on the slab long before it is to be mixed. It is best to place the powder on the slab first, arrange and divide it as desired, then place the liquid on the slab and mix immediately.

SUMMARY

Most of the profession realize that the zinc phosphate cements are none too satisfactory in clinical use. It is necessary to mix and use them in the best manner, since the use of a correct mixing procedure greatly improves the properties. A detailed mixing technic which prescribes: (1) the proportions of powder and liquid; (2) the temperature of the slab; (3) the rate of powder incorporation,

5. Footnote 1, first reference.

and (4) the time of mixing is one of the requirements in the American Dental Association's Specification 8 for a dental cementing medium. This requirement states that the mixing technics which accompany the individual packages of cement shall include the four foregoing items. Thus, any cement which complies with the Association's specification must have a satisfactory mixing technic accompanying the package.

A tabulation of the results obtained by a group of practicing dentists who conducted experiments on the zinc phosphate cements in their own offices under the direction of the American Dental Association Research Fellowship at the National Bureau of Standards seems to indicate that:

1. There is a wide difference in the physical properties among the trade brands of cement.

2. Different batches or colors of the same brand of cement may show a greater variation in physical properties than that caused by the variation in the cooperatin committees' technic for mixing.

3. Reducing the quantity of powder used in the mix increased the setting time and the amount of disintegration of set cement in water, while increasing the quantity decreased the setting time and the amount of disintegration. The optimum quantity of powder is the amount which will make the heaviest usable mix for the operation in hand.

4. Doubling of the mixing time tended to increase the setting time at both room and mouth temperature. In some cements, this was pronounced; while, in others, the effect was negligible.

5. Increasing the rate of incorporation of powder decreased the setting time.

6. Further neutralization of the cement liquid by the addition of a small amount of powder approximately one minute prior to mixing usually decreased the setting time.

7. Increasing the temperature of the mixing slab decreased the time of setting.

8. None of the cements tested were free from disintegration in either natural or artificial saliva. Some of the cements disintegrated more than others. There was practically no difference in the amount of disintegration of the cements in water or in natural or artificial saliva.

9. None of the cements tested were truly hydraulic. Immersion in water increased the setting time and gave a rough surface to the specimens.

10. The cements shrank on setting.

11. An exact mixing technic should be adhered to that the best possible results may be obtained from these cements.

IMPORTANCE OF EARLY RECOGNITION AND TREATMENT OF PERIODONTOCLASIA*

By ROBERT L. DEMENT, D.D.S., Atlanta, Ga.

THE importance of the early recognition and treatment of periodontoclasia is a subject which has been and still is sadly neglected by the dental profession as a whole, for no other reason, it seems, than carelessness or, shall we say, ignorance. We hesitate to say that this neglect is due to ignorance, but when we continue to have patients come in for examination and diagnosis with the statement that "Dr. Blank says that I have pyorrhea and there is nothing to do except remove the teeth—he doesn't believe in pyorrhea treatment," what other opinion are we to form?

At a meeting of the American Academy of Periodontology, held in New York City, in May, 1921, I heard Arthur H. Merritt read a paper entitled "A Brief History of Periodontology," in which he made the following statement:

> Diseases of the periodontium are as old as recorded history. Frequent mention is made by ancient writers of "loose teeth," "shaking teeth," "hemorrhage of the gums." In the Ebers papyrus, which dates from the thirty-seventh century, B. C., certain remedies are prescribed "to strengthen the gums."

The dental profession has made wonderful strides, particularly in recent years, but judging from what we see in the mouths of patients from day to day, the progress made by some of the members of our profession has been very slight, or nil, along the line of periodontology.

For the past seventeen years, I have been devoting my entire time to the practice of periodontia, and the thought grows stronger each day that the greatest service we can render our patients is to recognize the symptoms of periodontoclasia early and institute treatment immediately, before the normal contour of the supporting tissues has been changed and, perhaps, the teeth themselves are lost, to say nothing of the patients' health becoming impaired on account of the focus of infection in the periodontium.

THOROUGH EXAMINATION OF MOUTH

In examining the oral cavity, it is a natural tendency to center our attention on the things that particularly interest us. In other words, if we enjoy inlay work, we look for cavities in which to place inlays, and, if we are peculiarly adept at bridgework, we look for places to insert a bridge. Those who practice periodontia naturally observe the supporting structure of the teeth. A thorough examination should be made, taking the mouth as a unit, and each defect noted on a suitable chart, in order that we may have a complete record of the condition of the oral cavity and also may formulate a systematic plan on which to proceed in our endeavor to place the mouth in a healthy, sanitary and comfortable condi-

*Read before the Section on Periodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

tion. In this way, we render the patient a much more efficient and complete health service.

As a routine in examination, I would suggest the following procedure, after a cursory macroscopic examination of the mouth:

1. A complete roentgenographic review of the teeth and supporting structures, being careful of angulation in order to show clearly the interproximal spaces, crowns and root apices, without elongation or foreshortening. In some cases, extraoral plates should be made in third molar areas and also, at different angles, of some of the pulpless or suspicious teeth. 2. Study casts, if necessary. 3. Vitality tests of all suspicious teeth. 4. Clinical examination along with roentgenograms. 5. A case history. 6. Prognosis.

ROENTGENOGRAMS

In years gone by, it was my misfortune to encounter trouble because of failure to take complete roentgenograms before beginning treatment of oral conditions. Until we develop fluoroscopic eyes, we cannot always detect rarefied areas at the apices of teeth, although it is possible to detect some of these areas by digital palpation. We also need the roentgenogram in locating broken off roots, residual areas, interproximal cavities, cysts, unerupted teeth and periodontal lesions; determining the course of roots and the character of alveolar bone and as an aid in detecting traumatic occlusion, as well as other details. Of course, the taking of roentgenograms causes a little additional expense to the patient, but it makes for a much more complete and thorough health service, which, after all, is what the patient expects, and should receive. Without a complete roentgenographic review of every case, we are sure to overlook many pathologic conditions which would otherwise be found.

STUDY CASTS

Study casts are advocated by many periodontists in every case treated; but unless we are to do restorative work or the bite is to be opened and the whole occlusal relation changed, I have never felt it necessary or very helpful in my own work. In adjusting the occlusal relation, I have always depended on my knowledge of the occlusal relation, mechanical ability and patience and perseverance. I do not find it necessary to change the occlusal relation in every case; but when it is necessary, the grinding is done slowly and cautiously, then checked and rechecked, until, as nearly as possible, there is an equal distribution of stress, if possible in line with the long axis of the tooth.

VITALITY TESTS

Some dentists advocate a vitality test for each tooth in the mouth. I do not see the necessity of testing every tooth, but would suggest testing the vitality of every tooth holding a bridge which has been placed in close proximity to the pulp chamber or which looks at all suspicious. In other words, a tooth which raises a question in your mind as to its vitality should be looked on as a menace to health until proved healthy. Many times, teeth may be saved by root canal therapy if devitalization is detected before the cementum around the apex has been nicked by absorption and even before granulomatous areas appear. I am not a member of the so-called "100 per cent club," the group which believes in the removal of every pulpless tooth, since I have never been able to make myself believe that every pulpless tooth carries active infection. On the other hand, it is my opinion that much trouble has been started by the useless removal of teeth, breaking the arch and permitting the remaining teeth to drift into an inharmoni-

ous relationship with their antagonists of the opposing jaw and thus producing traumatic occlusion with its sequelae.

CLINICAL EXAMINATION

After making the necessary vitality tests, with the roentgenogram before us, we proceed to examine the oral cavity, starting with the tonsils and examining the soft tissues throughout. We next examine the teeth and periodontium, noting missing teeth, cavities, imperfect restorations (fillings and bridges), imbedded teeth, unerupted teeth, devitalized teeth and teeth which have drifted or are rotated or leaning. We then check the occlusal relation to see whether trauma exists, and the possibility of its relief, taking into consideration the anatomic relation as well as the amount of alveolar support remaining. Then with suitable explorers (I would suggest thin, flat explorers, not over 2 mm. in width), we probe around in the gingival crevice, noting its depth and particularly noting the depth of periodontal lesions found. If the crevice measures more than the normal, which is about 1.5 mm., it is outlined on the chart for special attention in treatment and observation. Each lesion and its depth is outlined on the chart. We also note the color and character of the gingival tissue, whether congested, hypertrophied, spongy, hard or anemic. We also note gingival recession, which is always accompanied by alveolar resorption. When we feel it necessary, we make bacteriologic slides. We started several years ago to make bacterial tests in every case, but soon came to the conclusion that it was unnecessary, since practically the same organisms were found in every case, these being streptococci, staphylococci, colon bacillus, diplococci, Vincent's spirochete and others.

In my early days of specializing in periodontia, I acquired the habit, as no doubt others have, of examining the gingival tissue macroscopically; and, if there were no visible evidences of pathologic change, I would, through negligence, and I suppose ignorance, give a negative diagnosis of periodontoclasia. In many cases, I would not even take roentgenograms. Perhaps there would be slight evidence of gingivitis. In such cases, I would recommend prophylactic treatment and instruction in mouth care and, with an application of aconite and iodine, dismiss the patient as having all the treatment necessary. As time went on and my knowledge increased, I began to take more time and pains in examinations, with the result that few patients leave my office now without having a positive diagnosis of periodontoclasia in some form. I soon learned that macroscopically I could not know what was going on in the gingival crevice, and while good, clear roentgenograms were wonderful aids in diagnosis, they could not be fully depended on to tell the whole truth, so I began, on these seemingly perfect supporting structures around the teeth, to probe with small blunt explorers the gingival crevice, and I know now that I overlooked many pathologic conditions. Now, before a patient leaves my office with a negative diagnosis, the gingival crevice all around each tooth has been explored thoroughly. This can be done rapidly, but at the same time thoroughly, after a little practice. Since the normal gingival crevice is about 1.5 mm. in depth, if the explorer passes to a greater depth, there is no doubt that a pathologic change is taking place and treatment should be instituted at this time.

CASE HISTORY

In treating any disease process, a thorough knowledge of a patient's age, general health and habits is of inestimable value. It is natural to assume that an

advanced case of periodontoclasia existing in the mouth of one who has reached the age of 50 or 60 years, and who has a history of poor general health, would not respond so well as a case in a young person of strong vitality. If the patient has developed such conditions as iritis, nephritis, arthritis, myocarditis, endocarditis, pericarditis or neuritis or any of the many other secondary conditions, we cannot afford to take as much chance in advanced cases as we would otherwise.

PROGNOSIS

After a thorough study of the case, it matters not how much we would like to retain certain teeth on account of their strategic importance, we must remember that even if all of the teeth have to be removed in order to eradicate all foci of infection, it is better to have a healthy mouth with artificial dentures than jeopardize the general health by leaving a pathologic condition. In older people, on account of the difficulty in learning to use artificial dentures, it is important to maintain as many teeth as possible to act as stays to partial dentures or removable bridges, if these teeth can be placed and maintained in a healthy condition. There is one grave mistake being made by many men in the dental profession which I would bring to your attention, and that is the habit of looking for signs of periodontoclasia in only those who have reached adult life. Of course, the percentage of those affected grows with advancing years, but it is surprising how many cases are found in the mouths of persons still in their teens or even younger. By placing a finger on the lingual and another on the labial aspect, with pressure, a small amount of pus and blood, which is a forerunner of much more serious trouble, can so often be exuded from the gingival crevice in the interproximal spaces, as well as from the labial and lingual aspects. At this stage, prophylactic treatment alone is not enough. The periodontal lesion is developing and periodontal treatment is indicated.

The greatest service the dental profession can render humanity is in the field of prevention. Even though the arrest of so-called pyorrhea alveolaris is a very worth while service, if we use every means at our disposal for the early recognition and treatment of incipient periodontoclasia, think of the advantage accruing to the patient.

When the gingival tissues lose their normal contour, the teeth and gums become less self-cleansing and, in many cases, are more difficult to clean by artificial means. The appearance is less pleasing in that the esthetic value of normal gingival tissue has been lost to a certain degree. In treating incipient periodontoclasia, there is much less pain, time and expense, as a rule. By treating the condition in its incipiency, the possibility of involvement of the general health through development of a focus of infection, loss of the teeth and impairment of mastication is avoided.

Of course, the ideal would be to prevent even the incipient cases of periodontoclasia, but until we understand more of endocrinology and the food requirements of the body, and can regulate habits of life, we cannot, I fear, reach such a utopia. By taking more time and exercising more patience and perseverance in teaching our younger patients home care of the mouth and impressing on them its importance, we can accomplish much in the way of prevention of gingival disturbances as well as caries, thus guarding the general health of our patients to a marked degree.

923 Doctors' Building.

THE NATURAL HISTORY OF THE HUMAN TEETH, By JOHN HUNTER: A STUDY

By M. F. ASHLEY-MONTAGU, New York City

INTRODUCTORY

ALL branches of knowledge, whether theoretical or practical, must, in the course of their development pass through two apparently necessary stages. The first may be called the stage of crude observation without organization, and the second, the stage of selective observation with organization. Until the year 1771, dentistry was in the midst of the first stage of development. The theories which informed its practice were as numerous and as varied as the proverbial leaves of Vallombrosa, and its practitioners were as poorly qualified to ply their art as any contemporary blacksmith or barber might be. Nor had the art of medicine, though vastly more developed, progressed beyond the same stage of development, even though the foundations for a rational medicine had been laid more than two centuries earlier by the great Italian anatomists and physicians. The art of medicine remained still to be organized and given coherent form. But even though the practice of medicine had not yet been adequately organized, successful attempts had long ere this been made to organize its practitioners, first in the university schools, then in the apothecaries and physicians guilds, in societies, and finally, in colleges of physicians and surgeons, bearing the charter of the king or state. Such organization of its practitioners was not to be achieved in the field of dentistry until the nineteenth century had well-nigh run its course. If it is considered that the foundations for a scientific medicine were laid in the sixteenth century, and that the practice of medicine was not organized until the eighteenth century in most European countries, the interval which elapsed between the development and organization of the practice of the arts of medicine and dentistry will be found to be rather shorter for the latter than for the former, for the foundations for a scientific dentistry were laid only in the last third of the eighteenth century. It is with the story of these foundations and the man who laid them that we shall be concerned in these pages.

The history of dentistry before the eighteenth century is closely identified with the history of medicine, of which, indeed, it was considered an intrinsic part. Long before the opening of the eighteenth century, special practitioners of the art of dentistry had made their appearance. Although it is difficult to say with exactitude when such specialists first appeared, there are records of practitioners of dentistry as early as in the sixteenth century. On the whole, such contributions as were made to dental knowledge came almost always from physicians and surgeons, and were generally incorporated by them in works dealing with the more general disorders and diseases of the body. Occasionally, an ambitious barber-dentist published a small pamphlet on the art of pulling teeth, but separate treatises on the art and science of dentistry there were none. The anonymous compilation

of observations on matters relating to the teeth published at Leipzig in 1530 and, possibly earlier, the *Zahnarzneybuchlein,* can, of course, hardly be considered such a treatise. Such knowledge of dentistry as was available before the eighteenth century represented merely the flotsam and jetsam of observations, practices and superstitions grown hoary with age, which floated about, loosely and unrestrainedly, in a sea of the most abject confusion, from which any one who cared to might pick such of the débris as he would use. It is really extraordinary how few men, during this period, were acquainted with even the most elementary details of the structure of a tooth, the diseases of which they pretended to cure or alleviate. Still more extraordinary were the methods commonly employed to produce such ends. This is not to say that there was not available a certain amount of fairly accurate knowledge relating to the teeth and their treatment: there was, but it was unorganized, and unorganized knowledge is tantamount to useless knowledge, for when knowledge is in such a state, it means that coexistent with it, environing it, and adulterating it, there exists a preponderant amount of knowledge which is false, and prejudicial to the possibility of distinguishing the false from the true.

Such was the nature of dental knowledge before the appearance of the work which, for the first time in the history of dental art, successfully organized the best existing knowledge on the subject, and by the liberal addition of the results of the author's own observations and practical methods, gave a marked impetus to the development of the art. This work, *Le Chirurgien Dentiste,* was the product of Pierre Fauchard (1690 [Brittany]-1761 [Paris]), "dental surgeon at Paris," as he describes himself on the title page of his book. This work, which, though written in 1723, was not published until 1728, may be described as truly epoch-making. It was the first considered and intelligent textbook on the art of dentistry. It may rightly be said that it gave to dentistry, for the first time, a definite meaning and a clear direction. In this book, which consists of two volumes duodecimo containing 863 pages, Fauchard deals with the anatomy, physiology, pathology and surgery of the teeth. He gives detailed descriptions of valuable surgical instruments invented by himself, and, in a section on *materia medica,* prescribes a number of extraordinarily interesting remedies calculated to alleviate diseases of the teeth and gums. He successfully disposes of countless vulgar errors with respect to the various alleged sources of disease of the teeth, and in a manner exemplary for his time surveys the whole field of dental knowledge.

Excellent and important though Fauchard's work was, it was not completely satisfactory as regards the anatomic and classificatory sides of the subjects dealt with. Fauchard had given meaning and direction to the art and practice of dentistry, but the theory and science of the subject had yet to await its Newton. Such a figure was to appear in the very year in which Fauchard's book was published; namely, John Hunter, who was born on Feb. 13, 1728, and who, forty-three years after his birth, in 1771, published as his first book a work entitled "The Natural History of the Human Teeth," in which the foundations and equipment for a scientific understanding of dentistry were well laid.

In 1778 appeared a second work by the same author intended as a supplement to the earlier book, "A Practical Treatise on the Diseases of the Teeth." From the "Advertisement" on the leaf following the title page in both these works, we learn that "MOST of the Observations contained in the following

Treatise were made by the Author before the year 1755; and the Substance of them constantly demonstrated after that period, in Doctor Hunter's Course of Anatomical Lectures."

Thus, it is to be observed that from the inception of his expressed interest in the subject, which found more formal expression in his anatomic lectures, Hunter allowed a period of a quarter of a century to elapse before publishing the results of his observations and experiments on the human dentition. He was never in a hurry to publish, but was most anxious to allow his ideas to mature upon a basis of experiment, checking, rechecking and experiment, again and again. "Don't think," he said to Jenner, "try; be patient, be accurate." The marks of the meticulous scientific man of genius are to be found in almost every line of Hunter's writings, yet his restraint in the matter of publication during his own lifetime cannot be too greatly regretted, for it led to the destruction of the greater part of the works in manuscript which he left behind him at his death, and to the obloquy of his brother-in-law, Sir Everard Home, who presented the observations recorded in some of them as his own work. The loss has been repaired, at least to some extent, by Richard Owen's editions of Hunter's works, published from the copies of the originals made by Clift, the faithful pupil of Hunter. But had these works never appeared, Hunter left enough published work of so distinguished a quality at his death as to ensure his lasting fame. One of the works which has most contributed to that fame is "The Natural History of the Human Teeth," one of Hunter's great masterpieces, and one of the great classics of natural science.

Though frequently mentioned, this book is but little known. It has long been a collector's item, and, as a result, is accessible today only in the libraries of our academies, and in a few medical libraries. For the rest, there must be a fair number of copies in the possession of private collectors. In this study, I propose making the contents of this remarkable work more widely available to those who have an interest in, but not the opportunity to consult, the original.

Before proceeding with the discussion of this work, a few details concerning the life of its author would not be out of place.

John Hunter was born Feb. 13, 1728, at Long Calderwood, Lanarkshire, Scotland. He was the last of ten children, and at his birth his father was somewhat more than 70 years of age. Until he was 20 years of age, Hunter was rather wild and intractable, not succeeding at any of the occupations he was put to, and having made an utter failure of the attempts of his school teachers to instruct him in the rudiments of learning. This failure affected him throughout the rest of his life, for it was only with great difficulty that he ever succeeded in expressing himself in English that was clear and untortuous. After he had failed at everything he had tried, his brother invited him to come to London. This invitation the rough, untutored boy accepted, arriving in London early in 1748. John's brother William was 10 years his senior. In London, he had already earned considerable fame as an anatomist by his lectures and demonstrations given at the Anatomical School founded by him in Covent Garden. Here, William set his brother to dissect an arm, and so excellent a task did John make of it that he was thereafter allowed full liberty to dissect what he would. To this new interest in his life John Hunter took with the most amazing ardor. His enthusiasm was untiring and his diligence in the prosecution of his studies from that time on until the day

of his death was as consistently admirable as it was prodigious. Hunter dissected constantly, "from the rising to the setting of the sun." He described about 500 different species of animal, and collected about 13,000 specimens relating to the natural history of both the plant and the animal kingdom. These specimens now form the Hunterian Collection of the Museum of the Royal College of Surgeons, London.

In 1756, Hunter was house-surgeon at St. George's Hospital, London. In 1760, he became staff surgeon to His Majesty's army, serving in that capacity in Belleisle in 1761, and in Portugal and the Peninsula in 1762; from which experiences resulted the famous posthumously published "Treatise on the Blood, Inflammation, and Gunshot Wounds," published in 1795. In 1763, Hunter settled in Golden Square, London, and began practice as a general surgeon. In 1767, he was elected a fellow of the Royal Society. In 1768, he was elected surgeon to St. George's Hospital, and in the year of Morgagni's death, 1771, he published "The Natural History of the Human Teeth," in the month of May, to be precise. Two months later, he paid the expenses of his wedding to Miss Ann Home with the profits derived from the sale of the book. In 1778 followed the second part of this work, the "Treatise on the Diseases of the Human Teeth." Thereafter, Hunter published a number of other treatises of distinguished merit. His practice and fame increased. He was appointed surgeon general to His Majesty's forces and surgeon extraordinary to the King, and, in the midst of his labors, he died, Oct. 16, 1793. He was interred in St. Martin's Field, and sixty-six years afterwards, in 1859, his remains were removed to Westminster Abbey, to rest in the pantheon of his peers in the sciences and the arts.

THE NATURAL HISTORY OF THE HUMAN TEETH

The first edition of "The Natural History of the Human Teeth" appeared in May, 1771. The bibliographic details concerning it and the other important editions of the work which appeared subsequently are provided in the following analysis:

HUNTER (JOHN).—THE/ NATURAL HISTORY/ OF THE/ HUMAN TEETH;/ EXPLAINING THEIR/ STRUCTURE, USE, FORMATION,/ GROWTH,/ AND DISEASES./ ILLUSTRATED WITH COPPER-PLATES./ By JOHN HUNTER, F.R.S./ And Surgeon to St. George's Hospital./ London,/ Printed for J. JOHNSON, No. 72 St. Paul's Church-yard./ MDCCLXXI.

Collation: Quarto, printed in Great Primer, 18 points, pp. viii-128. Half-title, THE/ NATURAL HISTORY/ OF THE/ HUMAN TEETH. (blank reverse) pp. i-ii; Title-page, as above (with blank reverse) pp. iii-iv; ADVERTISEMENT (with blank reverse) pp. v-vi; THE CONTENTS. pp. vii-viii; at the foot of p. viii there is an ERRATA note consisting of three corrections; TEXT, pp. 1-128. Following p. 128 there is a blank recto, p. cxxix, on the verso of which, p. cxxx is Plate I; p. cxxxi bears the EXPLANATION of Plate 1, there are sixteen such Plates and accompanying EXPLANATIONS. There is no Index.

The second edition appeared in 1778, accompanied by part two the "TREATISE on the DISEASES of the HUMAN TEETH." The latter was published separately for those who already owned the first work or wished only to own the latter, and was published bound with the latter for those who might wish to own the whole work in one volume. An examination of Part I of the second edition reveals that it is printed from the same plates as the first edition without the slightest change, except for the title

page. The particulars are as follows:

HUNTER (JOHN).—THE/ NATURAL HISTORY/ OF THE/ HUMAN TEETH:/ EXPLAINING THEIR/ STRUCTURE, USE, FORMATION,/ GROWTH, AND DISEASES./ ILLUSTRATED WITH COPPER-PLATES,/ By JOHN HUNTER, F.R.S./ SURGEON EXTRAORDINARY TO THE KING, AND FELLOW OF THE/ ROYAL SOCIETY/ LONDON,/ Printed for J. JOHNSON, No. 72, St. Paul's Church-yard./ MDCCLXXVIII.

Collation: Quarto, printed in Great Primer, 18 points, pp. viii-128; Half-title, THE/ NATURAL HISTORY/ OF THE/ HUMAN TEETH./ PART I./ [PRICE ONE GUINEA BOUND WITH THE SECOND PART.] (with blank reverse) pp. i-ii; Title-page, as above (with blank reverse) pp. iii-iv; ADVERTISEMENT (with blank reverse) pp. v-vi; THE CONTENTS. pp. vii-viii; at the foot of p. viii there is an ERRATA note consisting of three corrections; TEXT, pp. 1-128. INDEX, pp. cxxix-cxxxvi (pages unnumbered).

PART II (p. cxxxvii). Half-title, THE/ NATURAL HISTORY/ OF THE/ HUMAN TEETH./ PART II./ [Price Five Shillings sewed, or bound up with First Part, One Guinea.] (with blank reverse) pp. i-ii; Title-page, (with blank reverse) A/ PRACTICAL TREATISE/ ON THE/ DISEASES/ OF THE/ TEETH;/ INTENDED AS A/ SUPPLEMENT/ TO THE/ NATURAL HISTORY OF THOSE PARTS./ By JOHN HUNTER,/ Surgeon Extraordinary to the KING, and Fellow of the ROYAL SOCIETY./ LONDON,/ Printed for J. JOHNSON, No. 72, St. Paul's Church-Yard./ MDCCLXXVIII./ pp. iii-iv; THE CONTENTS, pp. v-vi. TEXT, pp. 1-128; p. cxxix is a blank recto of heavy plate paper upon the verso of which, p. cxxx, is printed the EXPLANATION to Plate I, opposite recto. There are sixteen Plates with accompanying EXPLANATIONS. There is an error in the arrangement of the Plates, for Plates XII and XIII with their EXPLANATIONS, have been misplaced at the end of the volume following Plate XVI.

This edition is a very rare one, and is here described from the only known copy, in the library of the Academy of Medicine, New York City.

The third edition of Parts I and II appeared in 1803, and was printed from entirely new plates, the modern "s" being substituted in this edition for the gothic letter throughout the text. The particulars are as follows:

HUNTER (JOHN).—The/ NATURAL HISTORY/ OF THE/ HUMAN TEETH:/ EXPLAINING THEIR/ STRUCTURE, USE, FORMATION, GROWTH, AND DISEASES./ ILLUSTRATED WITH COPPER-PLATES./ TO WHICH IS ADDED/ A/ PRACTICAL TREATISE on the DISEASES of the TEETH./ By JOHN HUNTER,/ SURGEON EXTRAORDINARY TO THE KING, AND FELLOW OF THE ROYAL SOCIETY./ LONDON:/ PRINTED FOR J. JOHNSON, NO. 72, ST. PAUL'S CHURCH-YARD./ BY W. SPILSBURY, SNOWHILL,/ 1803.

Collation: Quarto, printed in Great Primer, 18 points, pp. vi+246; Title-page, as above (with blank reverse) pp. i.-ii; ADVERTISEMENT. (with blank reverse) pp. iii-iv; CONTENTS OF PART THE FIRST. pp. v-vi; TEXT, PART THE FIRST, pp. 1-128; Title-page of Part II (with blank reverse) pp. 129-130; A/ PRACTICAL TREATISE/ ON THE DISEASES OF THE TEETH;/ INTENDED AS A/ SUPPLEMENT, OR SECOND PART,/ TO THE PRECEDING/ NATURAL HISTORY. INTRODUCTION. pp. 131-134; CONTENTS OF PART THE SECOND, pp. 135-136; TEXT, pp. 137-246; INDEX, pp. 247-253; page 254 is a blank verso; the succeeding page recto is blank and upon its verso is printed the EXPLANATION to Plate I opposite recto; there are sixteen

Plates reprinted from the First Edition without alteration.

That Hunter's "Natural History of the Human Teeth" was addressed, like the succeeding work, chiefly to the dentist is a point which seems to have been generally overlooked, but that this was so is rendered clear from Hunter's introduction to Part II, which is here transcribed in full:

THE importance of the Teeth is such, that they deserve our utmost attention, as well with respect to the preservation of them, when in a healthy state, as to the methods of curing them, when diseased. They require this attention, not only for the preservation of themselves, as instruments useful to the body, but also on account of other parts with which they are connected; for diseases in the Teeth are apt to produce diseases in the neighboring parts, frequently of very serious consequences; as will evidently appear in the following Treatise.

One might, at first, imagine that the diseases of the Teeth must be very simple, and like those which take place every where else in the bony parts of our body; but experience shows the contrary. The Teeth being singular in the structure and some other circumstances, have diseases peculiar to themselves. These diseases, considered abstractedly, are indeed very simple; but by the relations which the Teeth bear to the body in general, and to the parts with which they are immediately connected, they become extremely complicated. The diseases which may arise in consequence of those of the Teeth, are various; such as Abscesses, Carious Bones, &c.; many of which, although proceeding originally from the Teeth, are more the object of the Surgeon than of the Dentist, who will find himself as much at a loss in such cases, as if the Abscess or Carious Bone were in the leg, or any other distant part. All the diseases of the Teeth, which are common to them with the other parts of the body, should be put under the management of the Physician or Surgeon; but those which are peculiar to the Teeth, and their connexions, belong properly to the Dentist.

It is not my present purpose to enumerate every disease capable of producing such symptoms as may lead us to suspect the Teeth; for the Jaws may be affected by almost every kind of disorder. I shall therefore confine myself to the diseases of the Teeth, Gums, and Alveolar Processes; which parts having a peculiar connexion, their diseases fall properly within the province of the Dentist. I shall also purposely avoid entering into common Surgery; not to lead the Dentist beyond his depth, and to matters of which it is to be supposed he has not acquired a competent knowledge.

In order that the reader may perfectly understand what follows, it will be necessary for him previously to consider and comprehend the anatomy and uses of every part of a Tooth, as explained in my *Natural History of the Human Teeth,* to which I shall be obliged frequently to refer. Without such previous study, the Dentist will often be at a loss to account for many of the diseases and symptoms mentioned here, and will retain many vulgar errors imbibed by conversing with ignorant people, or by reading books in which the anatomy and physiology of the Teeth are treated without a sufficient knowledge of the subject.

Whichever of the connected parts be originally diseased, the Teeth are commonly the greatest sufferers. None of those parts can be distempered, without communicating to the Teeth such morbid effects, as tend to the destruction of them.

Thus, it is clear that the "Treatise on the Diseases of the Teeth" was written expressly for Dentists, and that Part I of "The Natural History of the Human Teeth" was intended by Hunter as an introduction and a groundwork to Part II.

Now, turning to Part I of "The Natural History of the Human Teeth," with which in this study we are alone concerned, we find Hunter beginning his account of this history of the teeth with a description of the jaws. The upper jaw

is briefly described, while the lower jaw is given more particular attention. Hunter writes that "In both Jaws 'the Alveolar Processes' are every where relatively proportional to the Teeth; being thicker behind, where the Teeth are larger, and more irregular, on account of the more numerous fangs inserted into them."

In the next chapter, the alveolar processes are considered. Hunter suggests that:

The Alveolar Processes of both Jaws should rather be considered as belonging to the Teeth, than as parts of the Jaws; for they begin to be formed with the Teeth, keep pace with them in their growth, and decay, and entirely disappear, when the Teeth fall. . . . In short, there is such a mutual dependence of the Teeth and Alveolar Processes on each other, that the destruction of the one seems to be always attended with that of the other.

In the succeeding chapter, an account is given of the articulation of the lower jaw which is a model of clarity and conciseness. The next chapter deals with the motion in the joint of the lower jaw. The following five chapters present a brilliantly effective account of the muscles of the lower jaw, the masseter, the temporalis, pterygoideus internus, pterygoideus externus and the digastricus.

The next, or eleventh, chapter deals with the structure of a tooth and first of the enamel. Here, the nature of the enamel is considered and the arrangement of its fibers described. The twelfth chapter deals with the bony parts of a tooth. By the bony part of a tooth, Hunter, of course, means the dentin. This is very thoroughly described, Hunter suspecting that the dentin is vascular from the fact that:

The fangs of the Teeth are liable to swellings seemingly of the spina ventosa kind, like other bones; and they sometimes anchylose with the socket, by bony and inflexible continuity. . . . but there may be a deception here; for the swelling may be an original formation, and the anchylosis may be from the pulp that the Tooth is formed upon being united with the socket. The following considerations would seem to shew that the Teeth are not vascular: First, I never saw them injected in any preparation, nor could I ever succeed in any attempt to inject them, either in young or old subjects; and therefore believe that there must have been some fallacy in the cases where they have been said to be injected—secondly, we are not able to trace any vessels going from the pulp into the substance of the new formed Tooth; and whatever part of a Tooth is formed, it is always completely formed; which is not the case with other bones. . . . But what is more convincing proof is reasoning from the analogy between them and other bones, when the animal has been fed with madder. Take a young animal, viz., a pig, and feed it with madder for three or four weeks; then kill the animal, and, upon examination, you will find the following appearance: first, if this animal had some parts of its Teeth formed before the feeding with madder, those parts will be known by their remaining of this natural colour; but such parts of the Teeth as were formed while the animal was taking the madder, will be found to be of a red colour. This shews, that it is only those parts that were forming while the animal was taking the madder, that are dyed; for what were already formed will not be found in the least tinged. This is different in all other bones; for we know that any part of a bone which is already formed, is capable of being dyed with madder, though not so fast as the part which is forming; therefore, as we know that all other bones when formed are vascular, because they are not susceptible of it after being once formed. But we shall carry this still farther; if you feed a pig with madder for some time, and then leave it off for a considerable time before you kill the animal, you will find the above appearances still subsisting, with this addition, that all the parts of the Teeth which

were formed, after leaving off feeding with the madder, will be white. Here then in some Teeth we shall have white, then red, and then white again; and so we shall have the red and the white colour alternately through the whole Tooth.

This experiment shews, that the Tooth once tinged, does not lose its colour; now, as all other bones that have been once tinged lose their colour in time, when the animal leaves off feeding with madder (though very slowly), and as that dye must be taken into the constitution by absorbents, it would seem that the Teeth are without absorbents, as well as other vessels.

In the thirteenth chapter, on the cavity of the teeth, we learn that "This Cavity is not cellular, but smooth in its surface: it contains no marrow, but appears to be filled with blood-vessels, and, I suppose, nerves, united by a pulpy or cellular substance. The vessels are branches of the superior and inferior maxillaries."

Chapter 14, on the periosteum of the teeth, tells us, among other things, that "It covers the Tooth a little beyond the bony socket, and is there attached to the Gum."

In Chapter 15, on the situation of the teeth, Hunter first uses the term *Cuspidatus* for the "canine" in view of its having but one biting edge. The first "grinder" is here for the first time referred to as the *Bicuspis,* since it is "the first Tooth that has a double edge."

In Chapter 16, on the number of the teeth, not only the number but also the parts of the teeth are considered and described. In this chapter, the term "molar" is used for the first time. Hunter writes:

The Teeth of each Jaw are commonly divided into three classes, viz., *Incisors, Canine,* and *Grinders;* but from considering some circumstances of their form, growth, and use, I choose to divide them into the four following classes, viz. *Incisors,* commonly called Fore Teeth; *Cuspidati,* vulgarly called *Canine: Bicuspides,* or the two first Grinders; and *Molares,* or the three last Teeth. The number of each class, in each Jaw, for the most part, is four *Incisors,* two *Cuspidati,* four *Bicuspides,* and four, five, or six *Molares.*

In Chapter 17, the "Incisores" are described in detail; in Chapter 18, the Cuspidatus"; in Chapter 19, the "Bicuspides," which, says Hunter, "especially the second of them, in both Jaws, are oftener naturally wanting than any of the Teeth, except the *Dentes Sapientiae.*"

In Chapter 20, the "Grinders" are most particularly described together with the relationship of their fangs to the antrum of Highmore. In Chapter 21, the Articulation of the Teeth is considered, followed by an account, in Chapter 22, of the gums.

Chapter 23 is devoted to the action of the teeth, arising from the motion of the lower jaw. Here, Hunter proves that the upper jaw and head do not move during mastication. "Let a man place himself near some fixed point, and look over it, to another distant and immoveable object, when he is eating. If his head should rise in the least degree, he would see more of the distant object over the nearest fixed point, which in fact he does not."

In Chapter 24 general comparisons are made between the motion of the jaw in young and in old people. The center of motion of the jaw in both young and old people is shown to be in the condyles. "In children who have no Teeth there does not seem to be a sliding motion in the Lower Jaw," owing apparently, to the nondevelopment of the articular eminence.

In this chapter, Hunter makes the important observation that

In proportion as the last Grinders are produced, the sides of the curve formed by the Jaws become longer, and push forward the fore part, none of the additional part passing backwards. The fore part

also continues nearly of the same size, so that the whole Jaw is longer in proportion to its breadth, and projects farther forwards.

Chapter 25 deals with the formation of the alveolar process, the development of which is traced from the fetus to the adult. Chapter 26 gives an account of the formation of the teeth in the fetus. In a few words, Hunter tells the story of the ossification of the teeth in a manner so accurate and clear that it has never been improved on. He shows how ossification of the "five little pulpy substances" in the fetal alveoli begins at about 5 months, first "on the edge of the first Incisors." And he makes the observation, scarcely known to modern students of the subject, that, at this age "the *Cuspidati* are not in the same circular line with the rest [of the teeth], but somewhat on the outside, making a projection there at this age, there not being sufficient room for them." He continues: "In the sixth or seventh month, the edges, or tips, of all these five substances are begun to ossify, and the first of them is a little advanced; and besides these, the pulp of the sixth Tooth has begun to be formed: it is situated in the tubercle of the Upper Jaw."

Chapter 27 deals with the cause of pain in dentition. The profound accuracy of Hunter's observational powers as displayed in this chapter leaves one astonished, for it was not until 1924 that Prof. Cyril West made an independent demonstration of Hunter's statements with respect to the vascularity of the gum over an erupting tooth.

Hunter writes as follows:

> The Teeth, when they begin to press against the Gum, irritate it, and commonly give pain. The Gums are then affected with heat, swelling, redness, and the other symptoms of inflammation. The Gum is not cut through by simple or mechanical pressure, but the irritation and consequent inflammation produces a thinning; or wasting of the Gum at this point. . . . Since the Teeth are to be looked upon as extraneous bodies, with respect to the Gum . . . there can be no doubt of the propriety of opening the way for them.

In Chapter 28, the formation and progress of the adult teeth, in their relation to the temporary teeth and their alveoli are considered. In Chapter 29, the manner in which a tooth is formed is described, and an account is given of the periodontal membrane.

In Chapter 30, the ossification of a tooth upon the pulp is most succinctly described, and, in Chapter 31, the formation of the enamel is dealt with. In Chapter 32, the manner of shedding of teeth is discussed, and the old error which attributed the shedding of the temporary teeth to the pressure above them of the permanent teeth is disposed of. Precisely what the mechanism of shedding is, Hunter, like his modern compeers, is unable to say.

In Chapter 33, the growth of the two jaws is considered. Here, Hunter points out, what has since by much labor been confirmed, that:

> The Jaw . . . increases in all points until twelve months after birth, when the bodies of all the six Teeth are pretty well formed; but it never after increases in length between the symphysis and the sixth Tooth; and, from this time, too, the Alveolar Process, which makes the anterior part of the arches of both Jaws, never becomes a section of a larger circle, whence the lower part of a child's face is flatter, or not so projecting forwards as in the adult. After this time the Jaws lengthen only at their posterior ends.

In Chapter 34, Hunter deals with the reason for the shedding of the teeth. He writes:

> If the child had been so contrived as not to have required Teeth till the time of the second set's appearing, there would have been no occasion for a new set: but the Jaw-bones being considerably smaller in

children than in adults, and it being necessary that they should have two Grinders, there is not room for *Incisores* and *Cuspidati* of sufficient size to serve through life; and the first formed Grinders having necessarily too small fangs, and the Jaw increasing at the back part only, these two Grinders would have been protruded too far forwards, and at too great a distance from the centre of motion. This variation in the size of the Teeth is likewise a reason why the second set are not formed in the sockets of the first, and why the old sockets are destroyed.

Chapter 35, on the cavity filling up as the teeth wear down, gives the first description of the formation of secondary dentin.

In Chapter 36, dealing with the alleged continual growth of the teeth, Hunter shows that the teeth "grow at once to their full length, and that they gradually wear down afterwards; and that there is not even the appearance of their continuing to grow."

In Chapter 37, on the sensibility of the teeth, Hunter traces the origin of the pain to the nerve in the cavity of the tooth, and the peculiar intenseness of dental pain, "as well as the quickness of the sense of heat and cold in Teeth," suggesting that the latter may be "owing to their communicating these to the nerve sooner than any other part of the body."

In Chapter 38, supernumary teeth are discussed. Such teeth would appear to occur "oftener in the Upper than in the Lower Jaw, always in the *Incisores* and *Cuspidati.*"

The use of the teeth, as far as they affect the voice, is discussed in Chapter 39, and it is shown that the fore teeth play the most important rôle, when they are lost, in bringing about alterations in the voice.

In Chapter 40, the question is asked "Under what class do the human teeth come?" Hunter hints at the carnivorous origin of man's teeth, and then adds that

> The light in which we ought to view this subject is, that man is a more perfect or complicated animal than any other; and is not made like others, to come at his food by his Teeth, but by his hands, directed by his superior ingenuity; the Teeth being given only for the purpose of chewing the food, in order to its more easy digestion: and they, as well as his other organs of digestion, are fitted for the conversion of both animal and vegetable substances into blood. . . . He ought, therefore, to be considered as a compound, fitted equally to live upon flesh and upon vegetables.

Chapter 41 consists of a short general discussion of the diseases of the teeth, in which most pain is said to arise "in a great measure from the air coming into contact with the nerve in the cavity of the Tooth." Caries and the mystery of its origin is next considered, and the filling of the teeth with lead, wax, etc., advocated, when possible, in order to allay pain and retard decay.

Chapter 42 deals with the cleaning of the teeth, in which the modern method of prophylaxis is advocated.

The final chapter (43) is concerned with the transplanting of teeth, in which it is shown that the teeth of one individual may be successfully transplanted in the jaw of another, "the success of this operation being founded on a disposition in all living substances to unite when brought into contact with one another."

With this chapter, the first scientific treatise, constituting as nearly a complete and original analysis of the human dentition as has ever been made, and representing one of the great landmarks of scientific progress, is brought to a close.

ROENTGEN-RAY STUDY OF THE TEMPORO-MANDIBULAR ARTICULATION*

By ROBERT R. GILLIS, D.D.S., F.A.C.D., Hammond, Ind.

SINCE 1885-1890, the movements of the condyle of the mandible and its relative position in its fossa have been the subject of much study and more speculation.

Three methods of studying the temporomandibular articulation have been used: (1) in the dry specimen; but this is without two vital factors, the interarticular cartilage and the musculature; (2) in the wet specimen (dissection); but this is without muscle action; (3) by dental casts mounted on an articulator; but this reveals only the changed position of a point of the condyle head and tells nothing of its relation to the fossa.

Each of these methods, owing to the omission of certain vital factors, compels the investigator to considerable speculation in reaching his conclusions; each method leaves much to be desired.

Until Dr. Prentiss and his colleagues were privileged a few years ago to examine a patient in whom an accident had removed the tissues that normally cover this articulation, we know of no one who had actually seen this articulation in normal function.

This roentgen-ray method promises, at least, an additional means of studying this articulation plus the added advantage of including the surrounding structures under natural functioning, under either physiologic or pathologic conditions.

For over three years, I have been trying to develop a technic to study this articulation by the roentgen rays. My efforts to date have not produced data from which conclusions should be drawn, but I was urged to make an introductory presentation of the subject here in the hope that others may be stimulated to similar efforts, and thus valuable data and experience accumulate from which determinations may be reached that will add to our store of knowledge and understanding of the temporomandibular articulation.

It will be my present purpose merely to introduce the subject, explain my technic, show certain results and possibly raise some questions without attempting their answers.

The several other osseous structures in the same transverse and horizontal planes cause considerable difficulty in so directing the roentgen rays as not to eclipse the desired area by confusing shadows.

Figure 1, left, shows the patient's head posed on the cassette holder and the tube directed toward the temporomandibular articulation, which lies next to the cassette. The tube is fitted with a special lead cylinder of which the distal end is cut off at a 20 degree angle; which permits ready adaptation to the patient's head. This cassette holder permits us to make pictures of four condyle-head positions with but a single posing of head and equipment.

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

Figure 1, right, shows the tube and lead cylinder posed in relation to the skull.

Figure 2 shows a side view of the skull with a point marked on the squamous portion of the temporal bone. This is the area covered by the lead cylinder and through which the roentgen rays pass into the head.

Figure 3, a rear view of a decapped skull with a rod showing the lateral angle of incidence of the rays, about 15 degrees downward.

shows the path of the roentgen rays, directed about 17 degrees posteriorly and across the sella turcica.

Figure 5, left, shows by transillumination the extreme thinness of that part of the temporal bone which forms the glenoid fossa, the area at which the rays are directed.

Figure 5, right, shows another decapped skull with a rod marking the angle of incidence of the rays.

Figures 6 and 7 are lateral views of the skull. The mandible is in centric occlu-

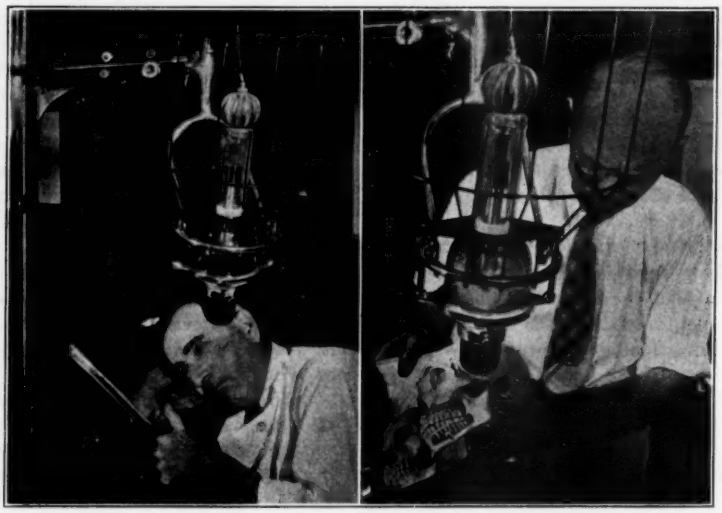

Fig. 1.—Patient's head posed on cassette holder; x-ray tube adjusted to head (left) and to skull (right).

Figure 4 shows the decapped skull as seen from above, with circular marking over that portion of the floor of the middle fossa which constitutes the roof of the glenoid fossa. This point or area is just anterior to that part of the petrous portion of the temporal bone which is known as the eminence of the semicircular canals and lies just at the foot of the anterior incline of this portion. The rod

sion and protrusive occlusion, respectively. We would call attention to the indicated space about the condyle head in centric occlusion, which is filled by the interarticular cartilage. The much greater space shown in protrusion is filled by a shifting of that same cartilage plus a small quantity of the investing tissues lying just in front of the external auditory meatus, which is forced inward by

external air pressure as the condyle head moves forward. This changed relation of the condyle head and glenoid fossa will be seen later in the roentgenograms.

Figure 8 shows four exposures on an 8 by 10 film. (The picture must be turned upside down for a study of the upper half in the right perspective.) To me, this picture is interesting because it is from a patient who has been edentulous for over three years. Having no teeth by which to determine centric occlusion, we used speech (saying "m"), and the lower left shows what might well be accepted as the usual relation in centric occlusion. With no teeth on which to use protrusion, the lower right shows little forward movement of the condyle head. When the picture is inverted, the lower left shows the open-jaw relation as in saying "awe"; and the lower right shows the condyle-head fossa relation when the patient forces his jaw shut to the maximum; in other words, far past centric occlusion, which is designated in these illustrations as $C\,O+$. I call attention to the fact that the condyle head does not encroach on or drive upward against the fossa, but rather the superior-posterior margin of the head is moved downward and backward. But more of this feature later.

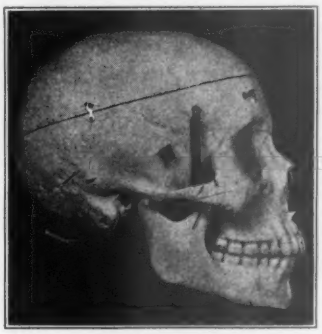

Fig. 2.—Mark on squamous portion of temporal bone indicating site in which tube is centered for study of condyle on opposite side of head.

Fig. 3.—Lateral angle of incidence for direction of roentgen rays (about 15 degrees downward).

Fig. 4.—Angle across floor of cranium that rays follow; about 17 degrees positively from point of entry and not quite parallel with crest of "eminence of semicircular canals" on side being studied. The line of the roentgen rays passes across the sella turcica. The circle marks the brain case floor forming the roof of the glenoid fossa.

Figure 9 was shown at the St. Louis anniversary meeting, in 1931, and at the Chicago Dental Midwinter Clinic in 1932. It shows condyle-fossa relations in three occlusions and rest position or centric relation. Maxillomandibular positions called centric relation and centric occlusion have been very generally accepted by denture prosthetists for some years. The usual definition for and ac-

ceptance of these terms makes the two coincidental. Since inaugurating this roentgen-ray study of the temporomandibular articulation, I am convinced that the two are not coincidental, and such papers as I have written during the past three years draw a distinction between the mandible than centric occlusion.

The accompanying illustrations show what the roentgen rays can reveal in certain cases. I have used centric occlusion, incisive occlusion, working occlusion and balancing occlusion as the positions in which we are most interested. I show

Fig. 5.—Light area (by transillumination) demonstrating extreme thinness of bone forming roof of glenoid fossa.

Fig. 6.—Skull showing centric occlusion, with shift of condyle when teeth are moved from centric occlusion to incision. The positional relations on the skull between the condyle head and the glenoid fossa in this and Figure 7 are to be noted and these pictures and the roentgenograms which follow are to be compared.

Fig. 7.—Skull showing protrusive occlusion, with shift of the condyle when teeth are moved from centric occlusion to incision.

the mandible's positions of centric relation and centric occlusion, centric relation being a more open position of some full natural denture cases, full prosthetic denture cases and some edentulous cases.

Figures 10 and 11 show the left and right sides, respectively, of a patient who has worn full dentures for years. The

condyle on the working side is almost in the same position as in centric occlusion and the balancing condyle position is much the same as in incision. Such similarity need not hold in other cases.

Figure 12 is of the patient shown in Figures 10 and 11. The picture in the center shows centric occlusion. A change is evident in the strained centric occlusion (upper left). The resiliency of the denture-bearing tissues evidently permits the condyle to drive into the interarticular cartilage; but when the dentures are removed and the patient closes far beyond centric occlusion, (upper right), the condyle head turns backward against the soft tissues just in front of the ear and externally from the glasserian fissure and toward the tympanic plate. (Compare Fig. 8.)

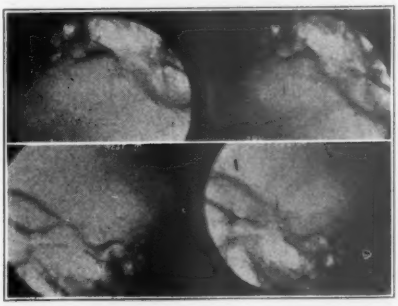

Fig. 8.—Four exposures on one 8 by 10 film. Below, left, rest position; right, slight protrusion. Above, mandible open as in saying "awe" and closed beyond centric occlusion.

Figure 13 shows the case of another patient, who has worn full dentures nearly ten years. The range of movement in mastication is evidently very short. Both natural and prosthetic dentures were arranged end-to-end in the incisors. This incisive position (upper right) was obtained only by protrusion beyond the functional range.

Figure 14 shows a case in which full dentures had been worn only a little more than one year. The patient is per-

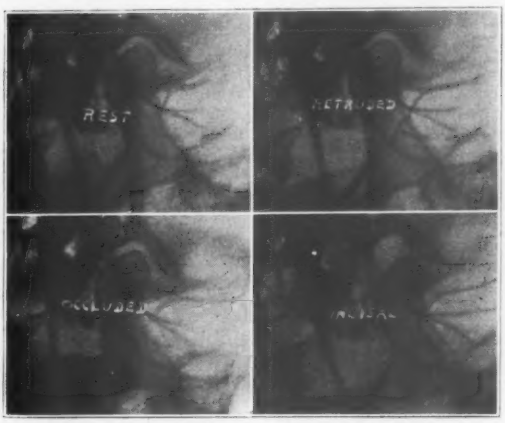

Fig. 9.—Condyle-fossa relations at (1) rest position of mandible or centric relation; (2) with teeth in centric occlusion (slight closure from rest position); (3) with teeth and mandible retruded beyond centric occlusion; (4) with teeth protruded to incisal position. Four relations of the mandible are shown in this condyle-fossa group, namely, rest, functional centric occlusion, retrusion and protrusion.

fectly happy and uses the dentures most efficiently, yet centric occlusion is built in a pronounced protrusive relation (upper left). The patient can retrude the teeth into what seems here to be the usual centric occlusion, but for him it is a strained retrusion requiring considerable effort (lower left). When he reaches incisive occlusion, the condyle is directly below the eminentia (upper right).

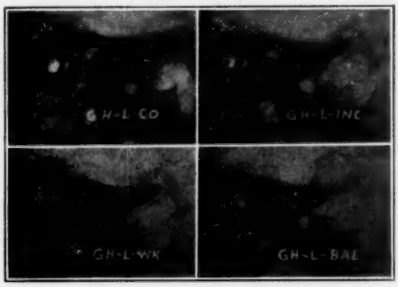

Fig. 10.—Above, left, position at centric occlusion; right, position at incision. Below, left, position as working side; right, position as balancing side of left condyle.

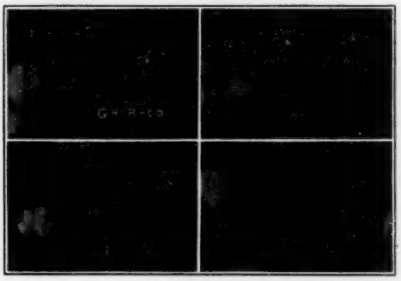

Fig. 11.—Like positions of right condyle (compare Figure 10). Figure 10, lower right, is simultaneous with Figure 11, lower left. In both Figure 10 and Figure 11, comparison of the upper left with the upper right view shows a condyle shift from centric occlusion to incision.

Figure 15 is a case of natural dentures with cusps well flattened by wear. The apparent spaces between the condyle head and the fossa in the several positions indicate very liberal jaw movements.

My respect for the interarticular cartilage has been greatly increased by this study. The magnitude of the movement of the condyle head is usually considerably greater with natural teeth than with prosthetic dentures.

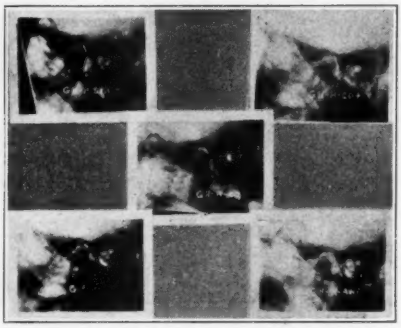

Fig. 12.—Right condyle in patient edentulous many years. For an understanding of the shift from centric occlusion to each other indicated relation or occlusion, the central view is to be compared in turn with each of the other pictures.

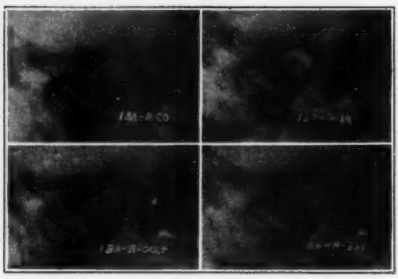

Fig. 13.—"End-to-end" arrangement in natural teeth. There is a relatively slight range of movement as compared with the range shown in Figure 15.

While I am not in a position yet to refute some of the conclusions drawn by

Dr. Prentiss and Dr. Summa relative to the thinning out and disappearance of the central portion of the interarticular cartilage in the "tripod mandible" and their interpretation of cases exhibiting a much shortened bite or a long edentulous history, to the extent that the condyle head actually wears directly against the fossa, these illustrations cause us to challenge

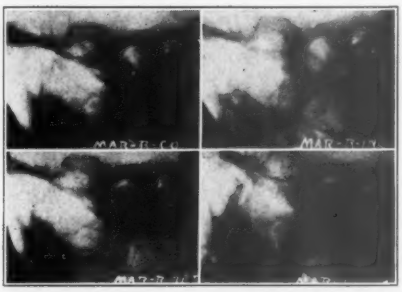

Fig. 14.—Case exhibiting for centric occlusion what is usually found as protrusive. A strained retrusion looks like the usual centric occlusion. Incision brings the condyle head directly beneath the eminentia.

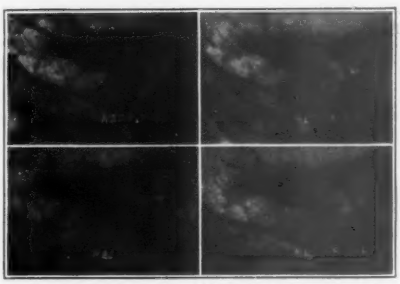

Fig. 15.—Case of full natural denture exhibiting well-worn cusps. The range of the condyle movement exceeds the range of that of most denture wearers.

such notions. Figures 16 and 17 show several cases wherein closure of the mandible is carried far beyond centric occlusion. Instead of the condyle head driving upward toward the fossa, it rotates downward and backward, compressing the tissues adjacent to the ear. Some of this group were among those shown earlier, and I call attention to but one, Figure 16, lower right, that of a patient who has worn an upper denture for over twenty years but "never could get along with the lower." The position taken by

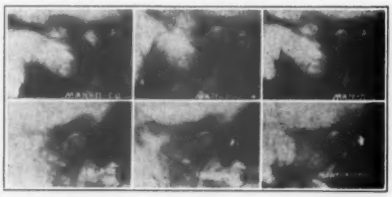

Fig. 16.—Left and center, backward and downward roll of condyle head when denture wearing patient removes denture and closes beyond centric occlusion. No upward thrust of the condyle against the fossa or cartilage is indicated.

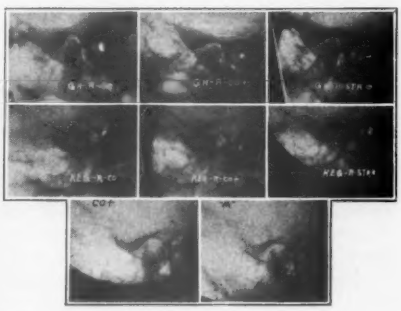

Fig. 17.—Left and center, backward and downward roll of condyle head when denture wearing patient removes denture and closes beyond centric occlusion. No upward thrust of the condyle against the fossa or cartilage is indicated.

the condyle head when the patient tries to masticate is to be noted. It is pulled away from the fossa. Of course, the hearing is diminished.

When sufficient data have been assembled, we will be able to study any changes that occur in this joint over a period of years, the difference, if any, in the effect of the use of the several forms of posterior teeth in dentures. We may have an added check for establishing the proper position for centric occlusion, and gain a much-needed better conception of proper occlusion.

THE LINGUAL ARCH: OBSERVATION ON ITS SCOPE AND STATUS AS AN ORTHODONTIC MECHANISM*

By B. G. DE VRIES, D.D.S., F.A.C.D., Minneapolis, Minn.

THAT the committee in charge of the program for the Section on Orthodontia of the American Dental Association has included among other subjects a consideration of three types of mechanical principles for the treatment of malocclusion indicates that they believe these three so-called systems to exist as distinct entities in orthodontic practice, each employed by its own group of practitioners, whose faith in each method seems verified and substantiated if we can rely on accomplishments which have been credited to their use. Oppenheim, in his recent treatise entitled "The Crisis in Orthodontia," says:

> The entire orthodontic profession is actually divided into four large parties; those who work with very strong forces to reach their goal as quickly as possible; those who sacrifice teeth to achieve their purpose, either with or without system; those who follow the old Angle method by using either the arch wire and ligatures or the modern Angle appliance (ribbon and edge-wire arch); and finally those who follow Mershon's principles. Furthermore, the pupils of all these various systems talk persistently of their success, without any consideration of the moral obligation to verify their results, particularly as to permanency, by proper publication of cases.

This situation, he goes on to say, has produced a chaotic condition in the minds of those who are beginners in the orthodontic field. In this group, we should include the general practitioners of dentistry who are attempting to treat malocclusion. This paper is not devoted to a discussion as to whether general practitioners should practice orthodontia, great as the temptation to discuss it may be. Thousands of words have been devoted to that question and thousands more will be written before that problem is definitely settled by the establishment of adequate educational standards which shall at one and the same time give the embryonic orthodontist an adequate basis for practice and the public a new confidence in the efficacy of orthodontic treatment. In the meantime, orthodontists and conscientious and well-qualified general practitioners, as well as poorly equipped opportunists in dentistry, will continue to dispense orthodontic service, good and bad, to a sometimes questioning public.

Since this paper is being listened to by orthodontic specialists and general dental practitioners alike, I should like to make

*Read before the Section on Orthodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

one point clear; namely, that while I am not antagonistic to the treatment of malocclusion by general dental practitioners in their efforts to render a service otherwise unobtainable, I do strongly feel that they will have to begin to include in their consideration of the treatment of malocclusion something more than mere mechanics: they will have to realize that any appliance unintelligently handled may become a menace rather than a help: they must begin to think of their responsibility to their clientele from the angle of probability of success or failure in treatment. A fee collected for a service not rendered is never a reward but a penalty exacted. When orthodontists are criticizing their own efforts as never before; when methods of treatment are being challenged daily, the general practitioner of dentistry is a trusting soul who pins his faith to an appliance alone.

As a matter of fact, while this paper is confined to a consideration of the lingual appliance, I do not consider it entirely irrelevant to inject another thought along the line mentioned above. It is my impression that we orthodontists have frequently allowed our enthusiasm to convey an erroneous impression to the general practitioner of dentistry, as well as to beginners in our field. We have demonstrated a continuous sequence of successfully treated cases of malocclusion. These successes have been largely attributed to the appliances which were employed. It must be remembered that the devisement of every appliance has been brought about because of attempts on the part of the operator to rectify some weakness in an earlier method. Out of the background of past failure has come the operator's perception of the potentialities inherent in appliances of various design. The neophyte does not possess this background. He sees a certain appliance produce given results in treatment and is likely to be unaware of the judgment in manipulation which has made such success possible.

I feel this to be especially apropos in a consideration of the lingual appliance as we know it today. Its simplicity of design and construction has gained it widespread popularity as an orthodontic mechanism. In many instances, this popularity has been supplanted by condemnation because of the operator's disregard of its limitations, overconfidence as to its potentialities and lack of understanding of its technical manipulation. I personally feel that the failure of an orthodontic appliance to fulfil the demands made on it in certain situations can be the means of much more rational development of its inherent efficiency under other conditions.

I do not consider it necessary to present at this time the historical development of the lingual arch wire in orthodontic technic. To one interested in this development, the history is available in the literature. Suffice it to say that, very early in orthodontic history, we find lingual wires used for orthodontic purposes, both as inactive retaining appliances and as active mediums for the movement of teeth. It remained for Mershon to really popularize the use of the lingual arch wire and, through his published findings and teachings, to present a philosophy of its application to orthodontia. This is the appliance which we shall discuss, specifically the removable lingual arch wire and its appendages known as auxiliary springs.

Primarily, the lingual arch wire demands a rigid attachment or lock on the lingual surfaces of the bands serving as anchorages, which shall at the same time permit the removal of the arch when necessary. This lock usually consists of a tube or tubes of some sort soldered perpendicularly to the anchor band, per-

mitting the exact fitting of a part or parts which have been similarly soldered to the wire itself. There are a great number of such locks now in use, each reflecting individual mechanical inventiveness. The two most commonly used are the round and half-round tube, the former providing a freedom in the rotary plane and the latter a definite fixation. The purpose of each and every lingual lock is the same; that is, control of the arch wire in its perpendicular and horizontal plane. If a lock fails to provide this type of fixation, it is very evident that much of the appliance's efficacy is lost, for the direction of force administered through auxiliary springs cannot be controlled from an unstable base. This is the first point that I wish to emphasize, for one of the chief criticisms of the lingual arch wire is its instability. It is imperative that the technic employed in the assemblage of all parts implicated in the lock be meticulous in its execution. If posts or shafts are soldered to the arch wire, this is especially necessary. Clean-cut approximation of all parts is demanded. At this point, I will state that, in my estimation, the time allotted in this program for the presentation of the lingual arch is quite inadequate for an intensive consideration of all phases of the essentials of the technic involved. I must therefore refer those interested to the information on these details which has already been published. Very accurate and beautifully illustrated works have been presented by Mershon, Oliver, Porter, Bach and others. We must, at this time, confine our attention to a more general discussion of the advantages and disadvantages of the lingual type of orthodontic mechanism.

Granted that one's technic has been flawless in the assemblage of a simple lingual arch wire, the successful use of the appliance will be hazardous unless due consideration is given to another obvious mechanical fact. I will state it as follows: Each and every amount of stress exerted against the teeth by a lingual arch wire itself or by its appendages must be directly reflected back on the arch wire anchorages. It makes no difference how light or heavy the arch wire may be: if but two molar teeth act as anchorages, they *must* absorb this stress alone unless reinforced. In this respect, it differs radically from any type of labial arch where many bands are used and where therefore stresses are largely reciprocal, depending on the segmentation of the arch wire through its attachments to the teeth. It has been pointed out that any and all teeth posterior to an anchor tooth provide adequate anchorage reinforcement, but it must be remembered that seldom if ever is a purely posterior force exerted in a horizontal plane against the anchorage when force is exerted by auxiliary springs attached to a lingual wire having no anterior reinforcement. This applies when either a perpendicular or a horizontal tube is used as a posterior attachment. I believe this to be due to the fact that lingual surfaces of anterior teeth provide a smooth slanting surface against which auxiliary spring wires bear in an uncertain manner and therefore allow a portion of their anterior thrust to be dissipated.

To control the placement of anterior auxiliary springs against such lingual surfaces and to overcome their tendency to slide incisally, a compensating antagonistic stress is often set up in the heavier lingual wire, which immediately is reflected back on the anchorages. Such a downward and anterior thrust from a lingual arch wire and its appendages produces a leverage which, if excessive, provides an ideal mechanism for the bodily tipping of the molar anchorages, which the mere presence of teeth posterior to

the anchorage is ineffectual in counteracting. No one who has consistently employed the lingual arch for any great length of time has failed to observe the facility with which this anchorage tipping is accomplished when an injudicious imbalance has been produced between anchorage and auxiliary spring stress. This fact places a great degree of importance on the method and intensity of stress which the operator must employ. Irish and others have attempted to measure accurately the actual amount of pressure which can safely be employed by an appliance. All such efforts are being made because of the distinct realization that excessive forces can very easily be developed which will act in an injurious and wrong manner.

To guard against the abuse of lingual arch technic, the operator must, in my opinion, adopt the theory expressed by Mershon. This, to state it briefly, embraces the adequacy of extremely gentle continuous pressure to produce bony changes required for the correction of malocclusion. In order, therefore, to manipulate properly the simple, unreinforced lingual arch with its delicate appendages, only gentle stresses, capable of toleration by the anchorages, must be employed. If the operator demands a technic which is rapid, which must afford him almost daily or weekly ocular evidence of radical tooth changes, he should pin his faith to another type of appliance. He must also determine for himself which method of orthodontic therapy is most liable in his hands to produce the best end-result. He cannot employ forces with a simple unsupported lingual arch which it might be considered safe to employ in an appliance more definitely controlled in its action on individual teeth. I reiterate, therefore, that, on the operator's conception of which he considers to be the proper method of tooth movement, depends the efficiency or inefficiency of the lingual appliance.

At this point, I feel that I must add still another class to Oppenheim's group of four classes of orthodontists who employ four distinct methods of technic. This is the group which has apparently demonstrated to its satisfaction the rationality in utilizing what it feels to be the advantageous features embodied in *all* orthodontic appliances. I cannot truthfully say that the lingual arch *per se* fulfils all of my requirements in an orthodontic appliance. It does fulfil some of them in a manner which I believe some others do not.

The lingual appliance functions as an orthodontic mechanism in two distinct ways. The first of these is its potentiality for imparting stress through the base wire. itself, and the second is the imparting of stresses through the medium of the auxiliary spring wires which are attached to it. The appliance thus employs two distinct mechanical principles in its operation. When the basal wire is employed as the activating force, it acts very definitely on the principle of the pin and tube appliance as far as stresses to the anchorages are concerned. For this reason, many of us find it admirably suited for accomplishing many movements of molar teeth, including rotations in any direction, tipping anteroposteriorly or buccolingually, elevating, and expanding. It is capable of very definite control in all of these movements. The action of the auxiliary springs, on the other hand, is practically a gentle activating stress against any single tooth or teeth through the medium of a fine round wire. This type of stress naturally is not capable of the control which may be exercised over the positive posterior portion of the arch wire proper, unless additional bands and attachments are provided. Its use in treating malocclusion of the deciduous and

mixed dentition of early childhood when general expansive stimulation is required seems indicated. As has been pointed out by many, efficacy of the appliance is here remarkable, and it possesses the advantages of inconspicuousness and cleanliness, as well as the requirement of the smallest number of banded teeth. Another point to be remembered where the deciduous second molars are used as anchorages is that the span of the base wire is comparatively short and therefore a higher degree of rigidity of the appliance is possible. When the partially erupted first permanent molars may need guidance, a delicate auxiliary wire appended distally from the posterior extremity of the appliance provides an excellent means of such accomplishment. Cases of the character just outlined constitute a field in which the lingual arch may well be the appliance of first choice.

When we enter that field of malocclusion wherein all of the permanent teeth anterior to the second permanent molars have erupted, the requirements to be met by any appliance must be carefully studied. Extreme rootwise movement of anterior permanent teeth may be necessary, as well as major rotation of individual teeth. In general, all such movements require definite control of the activating force. If this is true and a lingual appliance is to be the mechanism employed, adjunctive bands on individual teeth may have to be provided not only for directing the application of force by the auxiliary wires but also for controlling the required individual movements of the teeth. Special attention will also have to be given to the molar anchorages, for adequate support must be maintained. Under such circumstances, the simple lingual mechanism now takes on the attributes of a fixed-removable appliance, in that its original freedom has been curtailed and the principle of reciprocal force has been modified.

In cases of posterior occlusion of the mandible, I rarely, if ever, use only a lingual appliance on the maxillary arch. These are cases wherein intermaxillary rubber ligatures are used. I have attempted to utilize the bicuspid extensions advocated by Mershon to reinforce the molar anchorages against tipping when intermaxillary force is exerted against a plain labial arch resting in buccal molar tubes. Generally speaking, it has not been successful. I prefer in such instances to use a labial arch wire definitely attached to anterior teeth by some such attachment as the Angle bracket, Ketcham hook or McCoy tube. In addition thereto, a lingual arch wire is frequently used for molar and bicuspid expansion. In the same cases, on the mandibular arch, I usually place a simple lingual arch wire with suitable appendages and hooks on the lower molar anchorages for the reception of rubber ligatures. When we find a posterior tipping of the coronal portions of the lower anterior teeth, anterior auxiliary springs function admirably in tipping such teeth. In that connection, I believe with Oppenheim that in all cases wherein we do not have a fixed attachment of appliance and tooth as in the bracket type, the apex of the tooth becomes the fulcrum. There are many instances wherein this occurs and, in such cases, the free application of force through the auxiliary springs or round wire and McCoy tube is, I believe, preferable to a bodily movement mechanism. We might state that in malposition wherein the apex of a tooth root is more nearly in its proper position than the coronal portion, the free type of attachment acts most efficiently. Conversely, I believe such cases which exhibit the coronal portion of the tooth or teeth in more nearly the normal position

can better be treated and controlled by an attachment and mechanism which does not create a fulcrum at the root apex. This means a mechanism which causes the so-called "bodily movement" of teeth, and is represented by the ribbon or edgewise arch and brackets or similar device.

At the risk of appearing contradictory in my statements, I also wish to say that I believe a surprising amount of so-called "bodily movement" of teeth may be accomplished with the light stress of the auxiliary spring. I have noted that whenever this has been brought about, the time element has been greater and extremely light stresses have been employed as compared with those exerted when a different type of appliance has been used. I reiterate again therefore that the same philosophy of tooth movement cannot be applied to the use of all appliances. In the main, where the definite control and bodily movement of teeth are essentially indicated, I find a labial arch wire and proper attachments the preferred mechanism.

In the general consideration of the treatment of malocclusion, the operator sooner or later is confronted with the matter of the retention of teeth after movement has been accomplished. As I recall, Mershon has stated that he does not retain his cases after correction by his method, his reasoning being that, in the final analysis, endogenous conditions will establish the occlusal relations of teeth in the position and relation best suited to the particular person. The question has arisen in my mind as to whether Mershon's lingual arch wire technic does not embrace in its operation a definite principle of retention. Thus, his appliance, in his hands certainly, if rest periods in treatment are employed, acts also as a so-called "retainer" of the teeth in their new positions. If this is true, his cases would indubitably be "retained" as well as treated by his appliance. It is my belief that that form of retention which allows the teeth the greatest functional freedom should be the correct one, and the lingual appliance certainly possesses this quality. With but slight modification, an active lingual appliance can be converted into an inactive retaining appliance. I am not engaged in dental research, but as a clinician I have as yet failed to observe any apparent clinical evidence that rest periods in orthodontic treatment which has been accomplished by the gentle pressure of lingual arch technic have been disadvantageous to successful culmination of such treatment. Perhaps Mershon's statements regarding his nonuse of a retaining appliance is made with a "taken for granted" differentiation between fixed retaining appliances as commonly understood and the inherent quality of his own appliance to meet this requirement.

In surveying the literature pertaining to the treatment of malocclusion, one discovers the tremendous number of uses to which the lingual arch has been put in recent years. It would be a large task to enumerate these at this time. Once a fundamental idea has been presented, the inventiveness of modern dentists becomes evident. I have witnessed scores of orthodontic clinics demonstrating a myriad of uses of individual auxiliary wire designs and variations for different tooth movements. There are hundreds of such examples of inventiveness to be found, some good and some bad in principle. Hyperenthusiasm and its fellow overconfidence in something new which appeals to one's inventiveness have been responsible for much misleading data. It would be an exceedingly healthy measure for orthodontia if retractions of statements regarding successful therapy in treating malocclusion would be made with the same vehemence and conviction in case of dis-

covered error. Angle himself many years ago described his plain round wire expansion arch as the perfect mechanism, capable of directing and controlling all tooth movements. Its limitations and possible abuses have led to more and better developments. We still use the round labial arch wire and ligatures, but we have probably better evaluated their place in our mechanical equipment. I feel distinctly that it is unwise to make positive claims for the universal merits of any single appliance in treating all types and variations of malocclusion. Primarily, this type of loyalty, or call it what you will, to any single method produces factionalism and a debating ground for orthodontic practitioners, which should not exist. It is high time that orthodontia begin to more definitely collect its data as it relates to success and failure in treatment. This will demand a more definite basis of diagnosis and prognosis than we now possess, more enlightenment on the kind of force employed by an appliance, and less and less about definite, circumscribed systems or methods of treatment. For example, I have been unable to discern the difference between pushing a tooth with a gentle force or pulling it with the same force. I am interested in whether or not that type of force is correct. Perhaps the sporadic and intermittent force applied by ligatures to a heavy arch bar may be more physiologic, if we may use that term. Perhaps definite, absolute control of teeth is correct. If any one of these types of force can be proven to be the proper force for an orthodontic mechanism to express, it is not a question of discarding a Mershon appliance, an Angle appliance or a rigid bar and ligature, but rather the discontinuation of the particular wrong type of force in *all* appliances. Since the development of mechanics in our field has always kept the lead, our science seems to have progressed by trial and error. Our research workers must and will provide the evidence with which mechanics will have to comply.

In line with the foregoing, it becomes evident that I dislike to consider the lingual arch wire technic as a system. It rather declares itself to me as a means to accomplish certain orthodontic procedures which to date I have believed adequate. I would like to have you share this point of view.

DEFICIENCY DISEASES, PROTECTIVE FOODS AND DENTAL CARIES

By J. SIM WALLACE, M.D., D.Sc., L.D.S., F.A.C.D.. London, England

THE report of the Medical Research Committee on "The Present State of Knowledge Concerning Accessory Food Factors (Vitamines)" says, "It is difficult to implant the idea of disease as due to deficiency. Disease is so generally associated with positive agents—the parasite, the toxin, the *materies morbi*—that the thought of the pathologist turns naturally to such positive associations and seems to believe with difficulty in causation fixed by a minus sign."[1]

1. Medical Research Committee, 1919, Special Report Series No. 38, p. 2.

It might be said that it is all too easy to implant the idea of disease as being due to a deficiency. Nothing is easier than to get ailing people or even pathologists to believe that they are not getting enough of this, that or the other thing, and that many of their troubles are due to not getting what they want. Certain pathologists who were not fully conversant with ideas emanating from the dental profession imagined that dental caries might be a deficiency disease, though it had been perfectly well known, since 1890,[2] that caries was due to a positive and active condition external to the tooth and resulting from bacterial fermentation of carbohydrates under certain conditions. It should have been observed that although the prevalence of caries was to a large extent due to the deficiency or elimination of certain qualities of the food which tend to keep the mouth, teeth and alimentary canal in a hygienic state, the positive cause of these diseases was well known to be microbic.

To illustrate more clearly my meaning and to indicate how easily confusion may arise, let me refer to the cause of the prevalence of dental caries as put forward in 1900, and the positive, "actual" or "immediate" cause of caries which had previously been well elucidated and established by Miller and others. In my first book, which as the title indicates was "An Investigation into the Causes of the Prevalence of Dental Caries," it was noted that "it was not so much any particular foodstuffs which seemed to induce caries as the elimination of the fibrous part and its destruction by most methods of cookery." This statement, taken apart from the general thesis of the book, may have caused some confusion in the minds of those who did not know that the direct or "immediate" cause of caries was quite well known long before 1900, and that consequently it was largely to explain the cause of the prevalence of the disease and how it could be prevented that the book was written. Not only was it contended that the foodstuffs, being deprived of their accompanying parts, were liable to lodge and undergo acid fermentation in the mouth, but it was also noted that "from the same cause and induced conditions the micro-organisms of the mouth lodge and multiply and augment the rapidity and intensity of the acid fermentation."[3] A little later[4] (1904), I indicated the kind of bacteria which the carbohydrates specially induced to proliferate by inserting the words "acid producing" before the words "micro-organisms."

Among many who were but little acquainted with the significance of accessory food factors of a detergent or hygienic nature, there arose the notion that certain foods, from the point of view of nutrition, were protective against certain diseases, and the protection was attributed to vitamins. The idea that certain diseases could be prevented by eating certain foods was shown to be true long before the ideas associated with vitamins arose. Particularly was this so with regard to scurvy and the diseases of the teeth. When the vitamins began to attract attention, many saw that there was some similarity in the foods previously claimed to be preventive of dental caries from the point of view of oral hygiene and those which contained vitamins, more particularly vitamin C. It soon became

2. Miller, W. D.: Microorganisms of Human Mouth, Philadelphia: S. S. White Dental Manufacturing Co., 1890.

3. Wallace, J. S.: Cause and Prevention of Decay in Teeth: Investigation into Causes of Prevalence of Dental Caries, London: Bailliere, Tindall and Cox, 1900, p. 85.

4. Wallace, J. S.: Solution of Problem of Susceptibility and Immunity to Dental Caries, D. Rec., 24:1 (Jan.) 1904. (Reprinted in Supplementary Essays on the Cause and Prevention of Dental Caries, 1906, p. 51.)

known that this vitamin was generally present in fresh fruit and vegetables, and almost immediately the vitamin enthusiasts who did not know about the detergent effect of these foods on the teeth imagined that the excellent results in the prevention of caries which had been recorded when these foods were regularly included in the dietary, were due to this vitamin.

E. V. McCollum introduced the words "protective foods" (about 1918), but he evidently was not conversant with dental literature at first, and seemed unaware that certain foods, such as leafy vegetables, especially uncooked, and fruit, had already been recognized as preventive of dental caries by leading members of the dental profession. The idea of the prevention of dental diseases, and for that part other diseases also, by eating foods such as fruit and vegetables antedated his views by at least a dozen years.

Percy R. Howe was one of the first among dentists to make contributions which directed special attention to vitamins with relation to their supposed protective nature; but he, unlike many others, was fairly well acquainted with the idea that certain fibrous foods, such as fruit and vegetables, were very beneficial from the point of view of the prevention of dental caries and the maintaining of the hygiene of the mouth and alimentary canal. Following is a quotation from one of his earlier papers:

> Dr. Sim Wallace has been a strong advocate of coarse foods which cause the teeth to be vigourously used, and also calls attention to the cleansing effect of the fibre of the food. These are excellent recommendations. The use of an organ is necessary for its development. Disuse means atrophy. The cleansing effect of the fibrous food is evident, and induces firm gums and general well being of the mouth. But just as the roughage of the food acts in the mouth, so does it act and in a more important manner for systemic health in the intestinal tract. Here it keeps clean the intestinal absorption walls and strengthens the muscular tone. It prevents stasis and gives bulk to the food mixture, which indicates that more good is received from the food taken, among which is calcium. . . . In an experimental way this is markedly shown, for animals that have intestinal derangement respond very promptly to the use of filter paper, which, of course, is pure cellulose.[5]

All this, except the experimental way in which it "was markedly shown" to be true, had been maintained, and, by those acquainted with the evidence brought forward, generally accepted. Enthusiasm for vitamins by this time had become intense, and although Howe had acknowledged what had been brought forward about twenty years before, those who more recently commenced to study the subject concentrated the attention on vitamins alone, and failed to appreciate the importance of oral and alimentary hygiene. Even though Howe might have seen that the ideas which he epitomized in the paragraph quoted gave the proper explanation of the problem, he also was so carried away with the wave of enthusiasm for vitamins and calcium that he said, "It would appear that foods from a dental standpoint need to be considered from a general metabolic point of view, rather than from a local one alone." By this time also the supposed virtues of vitamins after absorption had become thoroughly confused with the theory that certain qualities of food promote oral and alimentary hygiene, as the result of bulk, physical consistency and the soluble extracts and stimulating principles which food generally has in its natural state. By those who did not know the explanation of the cause of caries which was made

5. Howe, P. R.: Some Experimental Effects on Deficient Diets, Proc. First Ann. Meet. Defensive Diet League of America, 1923.

some twenty years earlier,[6] milk came to be given a very prominent place among the foods which were preventive of dental caries, because it had been shown to contain vitamins A, B and C, and generally a trace of the so-called vitamin D. It may indicate how enthusiasm for vitamins confused those who never knew the origin of the idea that certain foods were protective against certain diseases, and how it came into vogue, if we refer to the statements of J. A. Tobey who, in addition to voicing the present-day ideas of many others made a direct attack on my views. He referred to a recent article of mine on dental caries,[7] and said:

> This writer, who apparently believes that caries is due to fermentable carbohydrates in the mouth, and who is not impressed by the conclusive scientific evidence as to the relationship of diet and tooth development, states that milk should not be consumed with easily fermentable cereal foods nor cooked nor eaten with sugar, although he adduces no scientific evidence to support this discredited theory. There is no evidence to support it. If the teeth owe their strength to mineral deposits activated by an abundance of vitamins provided by the ingestion of liberal quantites of such protective foods as milk, fruit and green vegetables, there will be no deleterious effects from accumulations of any substance in the crevices of the teeth. The evidence is overwhelming that good teeth are built from a proper diet and that all other factors are insignificant. Dr. Wallace alleges that the lactose in milk may be a potential cause of caries if milk is consumed just before going to bed.[8]

Tobey claims that "the absurdity of this statement" is apparent. He further says, no doubt quite truly, that I have been quoted as saying that "milk diet mixed with other highly fermentative carbohydrates when plastered about the crevices of the teeth leads to the destruction of the natural denture."[8] Tobey complains that I do not report any experiments to justify what he considers to be my erroneous assertions regarding milk, and that my views merely represent the views of a faddist. In the recent article to which he referred, I commenced with the following quotation, "Sunshine, cod liver oil, eggs, orange juice, tomato and milk—both human and fresh unpasteurized cow's milk—in good measure, singly or combined, do not prevent the rapid disintegration of the teeth of infants and small children. . . ."[9] Does Tobey consider that the research of Martha R. Jones, N. P. Larsen and G. P. Pritchard, from the report of which this quotation was taken, represents the views of faddists? Will he not admit that their research work does go some way to indicate that milk and vitamins are not of much or any use as protective foods with regard to caries? I also referred[10] to a similar research made in Hawaii by G. S. Millberry, who gives a photograph[11] of twenty-four pupils at the lower grades Haena School. In this group of children, only two of the pupils had defective teeth. Millberry gives another photograph[11] of eighteen of the upper

6. Wallace, J. S.: Footnote 3; Irregularities of Teeth, D. Rec., 22:240, 289, 337, 385, 1902; Rôle of Modern Dietetics in Causation of Disease; Supplementary Essays on the Cause and Prevention of Dental Caries, 1906; Prevention of Dental Caries, London: Office of Dental Record, 1911.

7. Wallace, J. S.: Recent Research on Dental Caries, D. Items Int., 54:913 (Dec.) 1932; 55: 16 (Jan.) 1933.

8. Tobey, J. A.: Milk as Protective Food for Teeth, D. Items Int., 55: 193 (March) 1933.

9. Jones, Martha R.: Larsen, N. P., and Pritchard, G. P.: Dental Disease in Hawaii, D. Cosmos, 72: 685 (July) 1930.

10. Wallace, J. Sim: Newer Knowledge of Hygiene in Diet, J.A.D.A., 18:1334 (July) 1931.

11. Millberry, G. S.: Study of Dental Problem in Hawaii, 1930, p. 96.

grades Haena School, in which only one child had defective teeth. Nevertheless, these children had no milk. Another photograph[12] which he gives shows fifty children at the Hanamaula School, Kauai. Every one of these fifty children suffered from dental caries. These children did receive milk. Though Millberry does not draw attention to the incidence of caries with special reference to the consumption of cow's milk, perhaps Tobey may do so now. I quoted also from another book,[13] in which, with regard to an investigation by Louise O. Kapp, the authors said "Surprisingly enough the children with the poor teeth actually drank more milk than those with the good teeth." It was admitted that in the "poor group the diets containing much milk also contained much carbohydrate (cereals, potato, sweets and candy) and little vegetable and fruit."

With regard to observations in England, I think the first important research of a scientific nature was reported by F. J. Bennett[14] in a communication read before the Odontological Section of the Royal Society of Medicine in 1910, entitled "The Destruction of Teeth by Milk Germs." The title of this paper indicates its purport, and incriminates the lactic acid bacilli of which "at least one form is to be found in the human mouth." Other investigations such as those recorded by R. B. Hunter and James Wheatley, dealing more particularly with a comparison of the incidence of caries in bottle-fed and breast-fed infants, indicate that neither the fresh raw milk taken direct from the mother, nor the prepared and sterilized cow's milk, makes the teeth specially resistant to caries. In fact, destruction of the teeth from dental caries was pretty nearly as rampant in the one group as in the other. The two latter researches are well recognized in England as they are epitomized in N. G. Bennett's "Science and Practice of Dental Surgery.[15] Another communication of a different nature by a former president of the Dental Officers' Group of the Society of Medical Officers of Health, entitled "Sixteen Years of Dental Clinical Work"[16] indicates the harmful results of a midmorning meal in which milk was encouraged as contrasted with the relatively beneficial results of a midmorning meal in which apples and crusts were permitted or in schools which discouraged eating between meals, except fruit, such as apples. Further, it may be mentioned that in perhaps all towns in Scotland where porridge and raw milk very generally form part of the breakfast meal, caries is correspondingly prevalent. I know of a family of six children in Scotland who were very liberally supplied with milk. They had a full average share of carious teeth. One in early childhood developed the habit of sucking such solid food as she ate, and at the age of about 30, she parted with all her natural teeth which had given her so much trouble both in and out of the dental chair. Another in early life took a great dislike to butter, but not to milk or cream, and for more than ten years substituted jam when eating bread, with of course disastrous results. Incidentally, notice should be taken of the effect of dietetic habits such as the foregoing when people say children all brought up on the same diet and in the same environment vary greatly in their "susceptibility" to or "immunity" to

12. Footnote 11, p. 93.

13. Blunt, Katharine, and Cowan, Ruth: Ultraviolet Light and Vitamin D in Nutrition, University of Chicago Press, 1930, p. 66.

14. Bennett, F. J.: Destruction of Teeth by Milk Germs, Tr. Roy. Soc. Med., 4:3, part 3, 1911.

15. Bennett, N. G.: Science and Practice of Dental Surgery, Vol. 1, 1931, p. 688.

16. Thorne, Rosa: Pub. Health, 45:210 (April) 1932.

caries. All this does not necessarily mean that cow's milk cannot be taken by children or adults, for where the pap system of feeding is not in vogue and detergent foods are freely used, the teeth are easily kept free from fermentable carbohydrates and lactobacilli and so from caries, particularly when but little sugar is consumed; e.g., Tristan da Cunha, Italy and several native states of Africa. Nor does it mean that milk products such as butter, cheese and cream are not quite useful for the teeth, when eaten with bread or other foods.

In view of the foregoing, it is not surprising that the idea of milk (mixed with carbohydrate foods) not being preventive of dental caries is widely accepted, and the views here maintained are clearly insisted on in the rules issued with the authority of the Council of the Society of Medical Officers of Health. Thus, in rule 4, we read, "Milk is a food and should only be taken at meal times, and must be followed by a tooth cleansing food," and in rule 6, the following sentence occurs, "The custom of giving milk and biscuits the last thing at night should not be allowed." These rules were issued in 1923 when vitamin enthusiasm was wild, but as the result of discussion on the subject off and on for two years before presentation of this report, the vitamin idea of milk being a protective food with regard to caries was abandoned, and, if I remember rightly, the committee in drawing up the rules was unanimous.

Here it may be mentioned that another cheap milk product, buttermilk, differs from fresh milk in relation to the cause of caries. When buttermilk is consumed, the acid formed from the lactose is free and not produced under a plaque which would retain it *in situ*. Indeed, the acidity of such milk tends to stimulate the secretion of the saliva and the self cleansing of the mouth generally. This should be borne in mind in speaking about quantities of milk consumed in different countries or by groups of people.

Tobey refers to researches which he asserts show the protective nature of milk, but the good results do not seem to me to have arisen from the use of milk, but from including fruit and vegetables or other detergent foods in considerable quantities in the diet. In one or more cases, in addition to this, sugar in the form of candy and sweetened carbohydrate foods was cut out of the diet more or less rigorously. Tobey seems to think that my contentions are not acquiesced in by research workers in America, and refers to the work of Professor Bunting and his collaborators. I am, of course, aware that Bunting in his experimental diet allowed milk, but as ample supplies of detergent foods were given, the acid-forming plaques of lactic acid bacilli and saccarolytic bacteria generally were presumably carried away. These bacteria were starved of the foods on which they best thrive, for sugar was reduced to a minimum and this minimum was mechanically removed from the teeth with detergent foods such as fruit and vegetables. The milk may not have been plastered about the teeth with sticky carbohydrates, and so may not have had the chance of causing the harm which we frequently see.

Whether Bunting was ever much or little impressed with the idea that milk was important with regard to making teeth resistant to caries, I know not. His inclusion of milk may have been from considerations not associated with the teeth, or possibly he has changed his ideas. In any case, in his last summary of the "Bacteriological, Chemical and Nutritional Studies of Dental Caries by the Michigan Research Group," he does not indicate that milk is a protective food as

far as caries is concerned, or that vitamin D, calcium or phosphorus in an ordinary diet requires to be supplemented by any special supplies of these ingredients. Perhaps it would be best to give his own words:

1. No consistent correlation could be found between amounts of salivary total solids, ash, Ca, P, Cl, diastatic activity, p_H, CO_2-capacity, or total alkalinity, and activity of dental caries. 2. No relationship could be found between intake of Ca, P, and vitamin D, or acid base dietary values, and activity of dental caries. 3. Evidence is submitted indicating that sugar is a very important consideration in dental caries. 4. A remarkably low degree of dental caries was observed in children on a low sugar diet deficient in Ca, P, and vitamin D.[17]

It was with regard to the prevention of the irregularity of the teeth that I specially drew attention to the uselessness of milk. It was to stimulate the healthy growth of the jaws that I advocated food which resembled milk from the point of view of nutrition, but which should differ from milk in its physical characters in accord with the physiologic requirements of the teeth which the child has at a particular time.[18] The full development of the jaw generally demands muscular activity and liberating stimuli to this end. The teeth are formed independently of functional activity, so that they attain their normal size even though the jaws are abnormally small, and thus irregularity is certain to result. Can we ignore the value of solid foods which stimulate mastication and omit them without due consideration of the effect? Can we consider a dietary "balanced" or "adequate" which does not contain a proper proportion of unabsorbable matter, such as cellulose? Most dieticians do not consider these points when they talk about balance, and when an infant becomes a child of $2\frac{1}{2}$ years, they seem to forget that the digestive apparatus from one end to the other has altered and that the milk which was appropriate in infancy is no longer suitable for the physiologic requirements of the jaws, teeth and alimentary canal generally. It certainly seems to me that the pap system of feeding children, which was introduced largely to counteract the well-known tendency of milk to form indigestible clots, does not at all satisfy the natural or physiologic requirements of the child's jaws and teeth even before the deciduous denture is complete. Moreover, diets such as would not be called balanced by any physiologist do not always predispose to caries, as for example the native diet of the Eskimo, or a diabetic diet, from both of which sugar and starch are very largely excluded. Bunting refers to a group of children in the U.S.A. which had a diet that could not be called adequate, but which was more or less caries free. "It was below the minimum standard requirement for calories in each age-group, and also inadequate in Ca, P and vitamin D contents. It contained little milk and no butter."[17] Thus, it seems that he recognizes the best method of bringing about so-called immunity to be to deprive the bacteria of the food which stimulates them to proliferation, i.e., sugar and candy, and to reduce their amount or number by detergent foods, such as fruit and vegetables, which stimulate the flow of saliva and the self-cleansing processes generally. Though of course highly appreciating the value of fruit and vegetables in the prevention of caries and pyorrhea, an idea which I introduced in my dietetic regime more than thirty years ago, it may here be said that this fruit and vegetable theory is becoming almost a fetish as regards the

17. Bunting, R. W.: J. D. Res., 14:104 (April) 1934.

18. Wallace, J. Sim: Physiology of Mastication, 1903, p. 31.

prevention of caries; for there are many other fibrous foods of a detergent nature, such as meat, fish, chicken and bacon, which are equally efficient, while fatty foods, such as butter and margarine aid in oral hygiene and certainly are not conducive to the proliferation of saccarolytic and plaque-forming bacteria.

Like Tobey, Boyd S. Gardner and Joseph L. Dillery[20] also make reference to my views on milk, apparently indicating that a case recently brought forward by L. T. Austin runs counter to them. The case was that of a patient who, as the result of a stricture of the esophagus, had perforce to live almost exclusively on milk till adult life. Austin and Vinson[21] asserted that the jaws were well developed and the teeth free from caries. In 1900, I said "Milk which is often a prominent part of young people's diet may, indeed, be harmless when consumed alone," and I still recognize that fact.[22] Thus, the case recorded by Austin and Vinson does not really clash with my views on caries. The photographs of the jaws and teeth which are given, to my mind, indicate quite clearly that even with "an unlimited supply of milk"—the supposedly "most nearly ideal food"—the teeth show just that type of general crowding which we so frequently see at the present day. A comparison of the photographs of the jaws and teeth with measurements[23] of a young man (of similar age to that of the Austin patient) who was deliberately brought up on a diet demanding mastication should convince anyone that the photographs in the Austin case were far from satisfactory as regards jaw growth and freedom from crowding of the teeth. So that, with regard to irregularities also, this case certainly cannot be claimed antagonistic to the theory I hold. Moreover, Austin and Vinson tell us that the margins of the gums were inflamed. According to accepted bacteriologic principles, the exudation of serum and leukocytes associated with this condition is altogether favorable to the proteolytic bacteria and antagonistic to the proliferation of acid-forming bacteria and so antagonistic to caries. The dietary régime which I introduced was intended to prevent not only caries and irregularity of the teeth, but also periodontal disease, formation of tartar and recession of the gums. For proper cleanliness of the gums, such friction as is associated with mastication and fibrous foods is necessary and we do not get this from milk. I may here mention that when two authors like Gardner and Dillery wrote on "The Confusion in Literature on the Etiology and Control of Dental Caries," they should have been specially careful not to add to the confusion, as they undoubtedly did; for apart from the confusion in their own minds which they implicitly admit and the further confusion which their article tries to portray, they made the following statements: "Wallace pointed out that children receiving such foods as cream, butter and eggs, all containing vitamin D, rarely suffer from carious teeth. The dog, which seldom receives these foods, remains free from caries. . . ." This is not only confusing but also erroneous; for I wrote:

Vitamin D is rather limited in its distribution. It is found abundantly in cod-liver oil. It is present in the yolk of eggs.

20. Gardner, B. S., and Dillery, J. L.: Confusion of Literature on Etiology and Control of Dental Caries, D. Cosmos, 75:699 (July) 1933.

21. Austin, L. T., and Vinson, P. B.: Normal Development of Teeth Associated with Enforced Dietary Restrictions as Result of Congenital Stricture of Esophagus, J.A.D.A., 20:1498 (Aug.) 1933.

22. Wallace, J. S.: Footnote 3, p. 90.

23. Wallace J. S.: Variations in Form of Jaws, St. Louis: C. V. Mosby Co., 1927, pp. 88-90.

Cream and butter contain small but generally appreciable amounts. Nevertheless, children who do get these foods are extraordinarily subject to caries, while dogs, which seldom get these luxuries, manage to keep free from the disease.[24]

Associated with the hygiene of the gums, resulting not from milk but from natural friction, we may likewise refer to the fact that detergent foods tend to polish the enamel and plane away the slight ridges and striae which are normal to the surface of newly erupted teeth, their use thus rendering the teeth easy to keep clean, bright and healthy looking. But as indicated, my chief objection to milk is with regard to the uses it is put to to soften foods and do away with the several desirable effects of efficient mastication; for it thus deprives the jaws and teeth of the uses for which they are intended. The importance of function with regard to the prevention of irregularity in the arrangement of the teeth and malocclusion is now generally recognized, and muscular exercises for correcting such derangement have been introduced with notable success. The conclusion seems to be inevitable that however excellent milk may be from the point of view of nutrition, more especially in the case of incorrectly or insufficiently fed children, it is unsatisfactory after, or indeed before, the deciduous denture is complete in promoting the full development of the jaws or the maintenance of dental and oral hygiene. Apart from this, there is not the slightest scientific evidence that there is any necessity for the use of cow's milk or any other milk in the diet after the natural period of weaning is passed, if the child is properly fed. In general, we may say that all animals in their natural state have teeth free from decay and similarly free from pyorrhea, irregularity and crowding, yet they never drink milk after the natural period of weaning is passed. Man in civilized countries indulges his children in this food after this stage. Is he any the better for it from a dental point of view? Is it natural for man to be dependent on cow's milk, which was certainly never intended for him? To these questions, we can emphatically say no. Yet Tobey appeals to Nature to show the absurdity of my ideas.

The preceding observations seem to lead to the following conclusions:

1. Apart from the fact that raw cow's milk is of all foods the most flagrant disseminator of disease and death in the state in which in many countries it is delivered or becomes even when "pasteurized" or "pure," it is by no means an ideal food for children or adults. Milk products, on the other hand, may be and frequently are valuable additions to the civilized dietary. Butter and cheese, and, in some countries, buttermilk, gained their established place without the "discoveries" of research workers, and from the dental point of view, I at least have nothing to say against their use. It may be recognized also that fresh milk has a place in modern cookery, but proportionally to its use in rendering food nondetergent, whether for breaking up the indigestible curd that cow's milk is apt to form, or for other reasons, precaution should be taken to give other foods of a detergent nature which will help to promote the growth of the jaws, the regular arrangement of the teeth and the natural hygiene of the mouth.

2. Research workers would do well to pass some time in studying not only recent articles but also the standard works of the leaders of dental thought for the last 100 years. It is by no means warranted after simply "reading numerous articles" to assert that "it is unlikely that investigators will ever be able to deter-

24. Wallace, J. S.: Footnote 10, p. 1332.

mine the answer to the problem by reviewing the dental literature."[20]

3. We may well be proud of the share the dental profession has taken in the advancement of its own science and in the collateral widespread influence it has had on science and medical thought, an influence which is bound to increase when, among other things, we get rid of the obsession that a pint to a quart of milk is "a necessity" for boys, girls and expectant mothers.

4. With regard to the elucidation of the problems associated with the etiology and prophylaxis of the diseases within its own province the dental profession can easily claim to be in the first place among the various branches of medical science.

5. For all practical purposes it is quite unnecessary to pay any attention to vitamins after a child is weaned. It has been shown experimentally that rats require less than 4 per cent of their foods to have vitamins in the rather limited proportion in which they are present in milk, while children and adults in civilized countries generally get more than ten times this amount. Further, it has been shown experimentally that among a class of children in which the diet was so bad that "few people in this country (Scotland) can be faring worse," vitamin concentrates have failed to do any appreciable good, and, consequently, "the time has come when the public must be educated to realize that vitamin supplements do not constitute a short cut to health."[25]

25. Sutherland, Robert: Vitamins A and D: Their Relation to Growth and Resistance to Disease, Brit. M. J., 1:795 (May 5) 1934.

THE NATURE OF THE ENAMEL MATRIX AT DIFFERENT AGES*

By SAMUEL W. CHASE, Cleveland, Ohio

IT is commonly known to histologists that enamel that has just been formed resists solution in the acids used in the common technical methods of preparing sections of decalcified specimens. Sections of enamel so retained show the morphologic elements of the enamel in their proper positional relationship, both prisms and interprismatic substance being represented by a soft, probably organic matrix.

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Later, after the enamel has been formed for some time, it is rare to find more than traces of the enamel in sections of decalcified teeth that have been prepared by routine technical methods. Even when special methods, designed to accomplish the retention of the organic matrix of the enamel, are employed (e.g., Bödecker's, Malleson's or Sudduth's), the results are variable. Many specimens leave no remnants of the enamel; some leave only the lamellae and occasional, often fragmentary, remains next to the dentino-enamel junction, and some specimens leave the remains of considerable amounts of enamel.

It is obvious that the difference in solubility or relative solubility between newly

formed and older enamel, and the difference in relative solubility between different specimens of enamel from adult teeth, must be ascribable to some difference in the chemical or physical nature of the enamel substance. Furthermore, since practically all newly formed enamel is relatively insoluble and much of the enamel which has been formed for a long time is relatively soluble, the difference in solubility must be due to some transformative process that takes place after the enamel has been deposited by the ameloblasts. The work described in this

Fig. 1.—Dissected jaws of human term fetus. The dental sacs are in place in the left mandible and are removed in the left maxilla. Enamel which is more than approximately 3 months old remains white after long preservation in formalin (upper incisors); whereas, enamel less than 3 months old becomes brown. (×1.5.)

paper is an attempt to answer several questions regarding this transformative process. These questions are:

1. When does this process take place with reference to amelogenesis?
2. Is the transformative process gradual and long continued, or abrupt?
3. What is the nature of the process?
4. Is there correlation between completion or noncompletion of the process and the production of well formed or poorly formed enamel?
5. Can posteruptive differences in the relative solubility of the enamel be demonstrated?

MATERIAL AND METHODS

The material includes:

1. *Developing Teeth.*—Many series of sections and individual sections of developing teeth of various ages from man, dog, cat, pig, rat and rabbit. These were

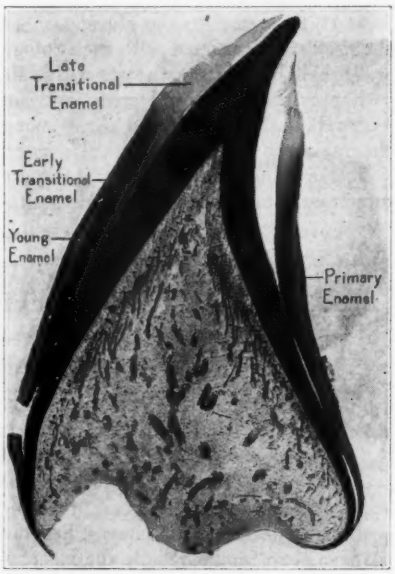

Fig. 2.—Upper central deciduous incisor of human term fetus, decalcified in 5 per cent nitric acid and stained with Mallory's connective tissue stain. Enamel which was white before decalcification (compare Fig. 1) has been dissolved; that which was brown is retained. The retained enamel exhibits the staining reactions of the primary, young and transitional phases of maturation of the enamel. (Compare with Fig. 5 *A*.) (×27.)

prepared by various technical methods, among which were:

Fixation: The solutions employed were 10 per cent formol, Zenker's fluid, Zenker-formol, Helly's fluid, Bouin's fluid, Carnoy's fluid, Sansom's modification of Carnoy's fluid, trichloracetic acid, Müller's fluid, saturated aqueous solution of mercuric chloride, 2 per cent potassium bichromate and Orth's fluid.

Decalcification: The solutions were 1 to 5 per cent nitric acid, trichloracetic acid, formic acid, formic-formol and von Ebner's fluid. Also, the methods of decalcification of Bödecker, Malleson and Sudduth were employed.

Staining: The stains employed were hematoxylin and eosin, Mallory's connective tissue stain, van Gieson's stain, Weigert's elastin stain, 2 per cent aqueous solution of acid fuchsin, picro-indigocarmine, methylene blue. The staining procedures of Unna, Buzzi, Dreysel-Oppler, Pasini and Disse were employed also.

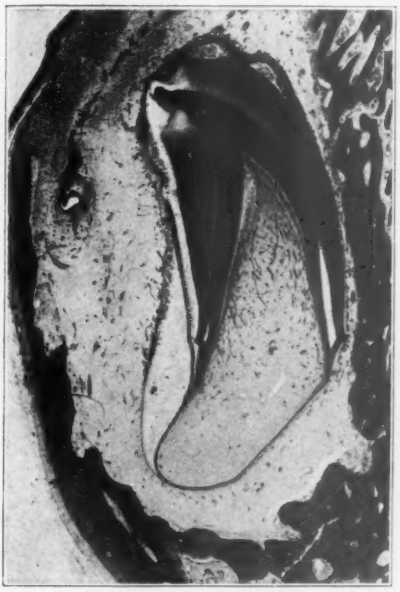

Fig. 3.—Lower lateral deciduous incisor of human term fetus, decalcified in formic-formol and stained with hematoxylin and eosin. Only that enamel which is less than approximately 3 months old is retained. The enamel over the incisal edge, more than 3 months old, has been dissolved. (Compare with Fig. 5 *B*.) (×19.)

Fig. 4.—Lower second deciduous molar of human term fetus, decalcified in formic-formol and stained with hematoxylin and eosin. None of the enamel on this tooth is older than approximately 3 months. All is retained after decalcification. (Compare with Fig. 5 *D*.) (×12.5.)

2. *Adult Teeth.*—These were mostly human teeth which had been fixed in 10 per cent formol. They can be divided, according to the methods used, into:

A. Those for which special methods of decalcification were employed.

(*a*) Mostly human teeth of unknown ages. The enamel of most of these was decalcified by the method of Bödecker, though the technics of Malleson and of Sudduth (this last method is often called Fleischmann's method) were also used.

(*b*) Forty-four human teeth of known ages. The enamel of all of these was decalcified by the method of Bödecker.

B. Those for which routine methods

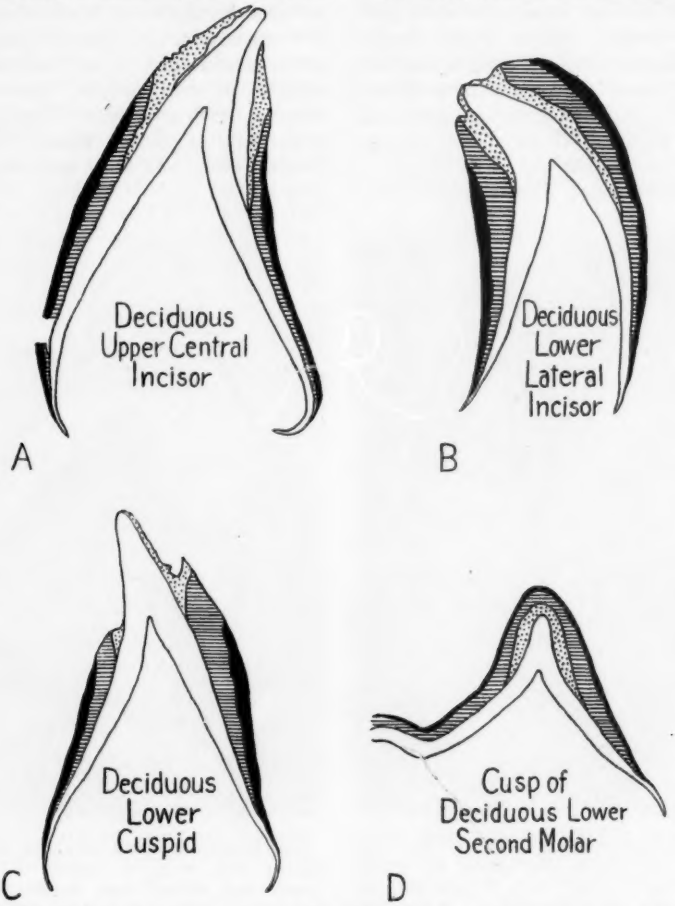

Fig. 5.—Distribution of decalcified enamel in different phases of maturation in four teeth from human fetuses at term. Primary and young enamel are shown in solid black; early (deeply basophilic) transitional enamel is hatched; late (faintly basophilic, staining palely) transitional enamel is stippled. Hard enamel is dissolved during decalcification. (Compare with Figs. 1-4.)

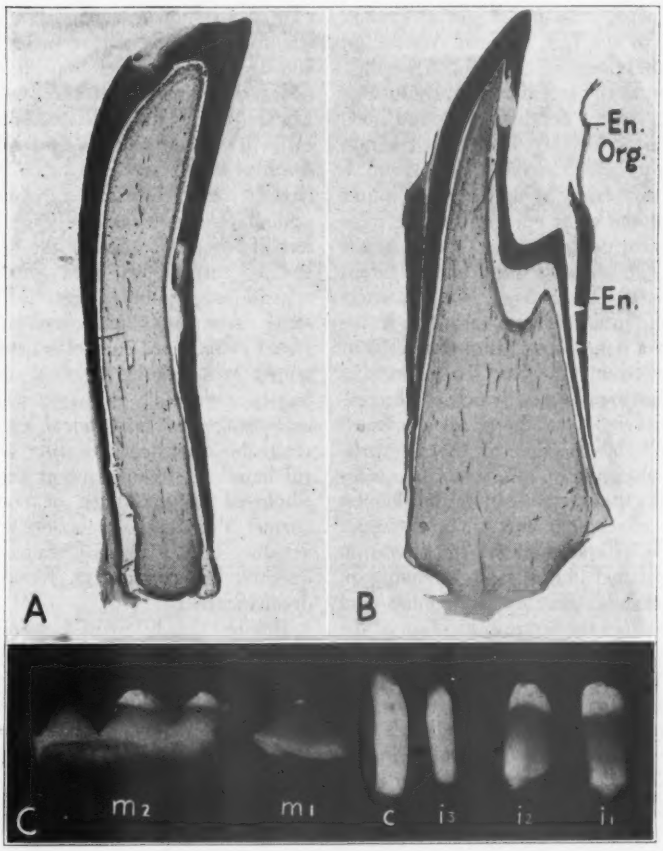

Fig. 6.—*A*. Section of decalcified lower left deciduous cuspid of pig at term, decalcified in 2.0 per cent nitric acid and stained with hematoxylin and eosin. All enamel was in the hard phase of maturation and has been dissolved. (×9.5) *B*. Section of decalcified lower left first deciduous incisor of pig at term, decalcified in 2.0 per cent nitric acid and stained with hematoxylin and eosin. All enamel which was in the hard phase of maturation has been dissolved. All which is in the transitional, young and primary phases is retained. (×9.5) *C*. Six lower right deciduous teeth from fetus referred to in *A* and *B*. The distribution of enamel in the hard phase of maturation (white after formalin preservation) and earlier phases (brown after formalin preservation) is shown. (Compare with *A* and *B*.)

of decalcification were employed. Most of these teeth were decalcified by methods employing nitric acid in strengths of from 1 to 5 per cent. Schaffer's method was used for many. Some specimens were decalcified in formic-formol, others in von Ebner's fluid or in potassium bichromate.

The stains employed for adult teeth were mostly hematoxylin and eosin and Mallory's connective tissue stain.

In a paper read at the seventh annual meeting of the International Association for Dental Research, in 1929,[1] I called attention to the fact that recently formed enamel, after decalcification, exhibits three fairly sharply demarcated strata which correspond strikingly, in their reactions to stains, with the three outer strata of the volar epidermis. The most recently formed, very thin stratum of the enamel, immediately next to the parent ameloblasts, consists of the intensely basophilic interprismatic substance in the form of a honeycomb. Into the "cells of the honeycomb" project the acidophilic ameloblastic processes, which are becoming converted into the enamel prisms.[2] The staining reaction of the interprismatic substance in this stratum is very much like that of the granules or globules in the cells of the stratum granulosum of the volar epidermis. A thick stratum of the enamel immediately following on the basophile zone is acidophilic and stains as does the stratum lucidum of the epidermis. The similarity of staining reaction extends even to the matching of peculiarities of tone and shade in certain staining methods, notably Mallory's connective tissue. Immediately following on the acidophilic zone is a much wider zone, in which the decalcified enamel again becomes basophilic, staining as do the deeper layers of the stratum corneum of the epidermis. Older layers of the decalcified enamel are successively less intensely basophilic, finally becoming only very faintly tinged by basic dyes, and again exhibiting a parallelism with the deeper and more superficial layers of the stratum corneum of the epidermis.

Later (1932),[2] I pointed out that two of the zones which have different staining reactions in the newly formed and decalcified enamel coincide with the zones of immature enamel which von Ebner (1906)[3] differentiated polariscopically in ground sections and called, respectively, primary (the basophilic zone next to the ameloblasts) and young (the acidophilic zone) enamel (Fig. 2). The second basophilic zone of the decalcified enamel corresponds with von Ebner's transitional enamel (Figs. 2-5). The stage of enamel maturation which von Ebner called hard enamel is never represented in decalcified sections, since it is totally dissolved. Primary, young and early stages of transitional enamel are retainable after decalcification, with careful handling, irrespective of the technic employed. Later stages of transitional enamel, that is, those portions which react only faintly to basic stains, are frequently, but not always, retained after decalcification.

Besides the differential staining reactions of the decalcified primary, young and transitional enamel, there is another difference between that enamel which resists solution during decalcification and that which is readily soluble. In the developing teeth of fetuses which have been long preserved in formalin, enamel which has been recently deposited assumes a brown hue; whereas, enamel which has been longer deposited remains white (Figs. 1 and 6*C*). After its first deposition by the ameloblasts, human enamel remains in the phase in which it turns brown in formalin for approximately three months, then is rather abruptly transformed to the phase in which it remains white in formalin. The upper incisors of a human term fetus, shown in

1. Chase, S. W.: Additional Evidence of Keratinous Nature of Enamel Matrix, J. D. Res., 9:288 (June) 1929.

2. Chase, S. W.: Histogenesis of Enamel, J.A.D.A., 19:1275-1289 (Aug.) 1932.

3. Von Ebner, V.: Über die histologischen Veränderungen des Zahnschmelzes während der Erhärtung, insbesondere beim Menschen, Arch. f. mikr. Anat., 67:18-81, 1906.

Figure 1, have the white enamel in only the incisal two fifths of their crowns, the rest of the enamel being brown. The boundary between white and brown enamel lies at the level of the crown, which was being formed at about the twenty-eighth week of fetal life (computed from data given by Eidmann, in 1923[4]). Hence, all the brown enamel should be less than approximately 3 months old; whereas, all of the white enamel should be older than 3 months. Similar computations on many other developing teeth give confirmatory evidence that the transformation from the brown phase to the white phase occurs at about 3 months (the range is from 11 to 14 weeks).

If teeth which exhibit these two types of enamel superficially are decalcified, all enamel which was brown is retained; whereas, all enamel which was white is dissolved (Figs. 1-6). The insoluble remains, when sectioned and stained, are found to represent enamel that is in the primary, young and transitional phases of maturation (Figs. 2-5). The soluble enamel is that which has fully matured to the hard phase. That the boundary between the relatively insoluble and the soluble enamel is often sharply defined is shown by the fact that the free border of the decalcified remnants frequently tends to parallel the direction of the incremental lines (lines of Retzius) at its level (Figs. 2, 3 and 5*A*). This is not uniformly the case, probably because transitional enamel becomes relatively soluble toward the end of this phase (Figs. 5*B* and *C*).

AMOUNT OF ENAMEL REMAINING AFTER DECALCIFICATION OF ENAMEL THAT WAS MORE THAN 3 MONTHS OLD

Age of Enamel	Specimens in Which Considerable Amounts of Enamel Were Retained*		Specimens in Which There Was No Enamel Remaining or Only Scanty Remnants Next to Dentino-Enamel Junction	
	Number	Percentage	Number	Percentage
First decade	21	43	28	57
Second decade	11	48	12	52
Third decade	2	50	2	50
Fourth decade	8	57	6	43
Fifth decade	8	57	6	43
All five decades	50	48	54	52

*From one-third to entire thickness in at least some part of specimen.

4. Eidmann, H.: Die Entwicklungsgeschichte der Zähne des Menschen, Berlin, 1923.

Beust (1928)[5] has called attention to the relatively insoluble immature enamel of the pig and the fact that it is present in nearly its entire adult thickness before the hardening process, which requires months, is completed. His statement that "that which has heretofore been taught about the 'rhythmic' deposition of the enamel, whereby the striae of Retzius are said to be formed, is based on a misconception" is correct in the sense of his further statement that "the ameloblasts do not deposit finished layers of enamel," but is certainly incorrect in the sense that there is no rhythmicity in the maturation of the enamel. That maturation of the enamel is a rhythmically progressive process has already been demonstrated polariscopically by von Ebner (1906), whose findings are supported by my demonstration of the differentially staining zones in decalcified sections of immature enamel. The arrangement of these zones is shown in Figures 2-5. In all of the sections that these figures represent, the boundaries between the primary and young enamel and between young and transitional enamel parallel the direction of the incremental lines. The boundary between early transitional (deeply basophilic) and late transitional (weakly basophilic) enamel is usually less definite, but where it is well-marked, it too tends to parallel the incremental lines.

When enamel which has been formed for less than three months is retained after decalcification, both the prisms and interprismatic substance are preserved. The remains of enamel that is more than 3 months old may consist of both prisms and interprismatic substance, the interprismatic substance alone, the prisms alone or, rarely, an amorphous residue of basophil, granular nature. In the enamel of a given tooth, the remains may be all of one type; or two or more types may be found in different parts of the remains.

The remains of enamel that is more than 3 months old always exhibit the staining reactions of immature enamel. Most frequently, they stain as does enamel in the transitional phase of maturation. Occasionally, enamel in the young phase is found, usually in association with transitional enamel. Rarely, the remains are in the primary phase. (In my paper on the enamel prisms and interprismatic substance, in 1927,[6] the description of preparations in which the prisms were stained with eosin or fuchsin, while the interprismatic substance was stained with hematoxylin or anilin blue, must have been based on sections of primary enamel, since this is the only phase of enamel maturation in which such differential staining occurs.)

To answer the question as to whether there are posteruptive changes in the relative solubility of enamel, seventy-two human teeth of known ages were decalcified. Forty-four of these teeth had completed crowns. The enamel of these was decalcified by the method of Bödecker, sectioned serially, and stained in hematoxylin and eosin. The other twenty-eight teeth had crowns which were in various stages of development. These were decalcified by several different methods, sectioned serially and stained, mostly in hematoxylin and eosin. The specimens were then divided into five age-groups, representing the first to the fifth decades of age of the enamel (determination of age based on the tables of calcification of Peirce,[7] 1884, and Eidmann,

5. Beust, T. B.: Intrafollicular Enamel Development, J.A.D.A., 15:2021-2031 (Nov.) 1928.

6. Chase, S. W.: Enamel Prisms and Interprismatic Substance, Anat. Rec., 36:239-258 (Sept.) 1927.

7. Peirce, C. N.: Calcification and Decalcification of Teeth, D. Cosmos, 26:449-455 (Aug.) 1884.

1923). Finally, in each age-group, the specimens were examined and a record was made of the amount of enamel which had been retained in each following decalcification. These data were assembled with the result shown in the accompanying table. In cases in which the crown was begun in one decade and completed in the next, also in cases in which there were large amounts of remains in one region and no remains or scanty remains in another, two entries were made in the table; hence, there are 104 entries for the seventy-two teeth involved.

When these data are compared, it is found that there is no significant difference in the amount of enamel retained after decalcification in any decade of enamel age from the first to the fifth inclusive. Considerable amounts of enamel resisted solution in the decalcifying acids in approximately half of the specimens of each decade. That the retention or nonretention of remains of the enamel is not in large measure due to the capriciousness of the method of decalcification is shown by the fact that, when several specimens of enamel from the same tooth are decalcified separately, the amount and nature of the remains are similar in all of the resulting preparations. For example, seven specimens of enamel from the two lower third molars of a 17-year-old boy all had portions in which the enamel was retained in its entire thickness; whereas, none of four specimens of enamel from the lower third molar of a 23-year-old woman showed more than an occasional minute remnant of enamel next to the dentino-enamel junction.

In view of these findings, it is probable that enamel has reached the end-point of its process of maturation approximately three months after its initial deposition by the ameloblasts. The end-point may lie in any phase of maturation—primary, young, early transitional, late transitional or hard enamel. Whatever phase of maturation is attained at the end of three months is the permanent condition of that enamel, and there is no further change that affects its solubility during technical processes of decalcification.

The fact that the remains of enamel, after decalcification of adult teeth, usually stain as do the remains of transitional enamel, but sometimes as do the remains of young or primary enamel, points toward the conclusion that such remains are recovered, after decalcification, only from enamel that has not passed completely through the phases of enamel-maturation.

So-called hypoplastic enamel is apparently largely enamel which has not completed maturation, since it is often retained, after decalcification, in its entire thickness. The third molars of the 17-year-old boy mentioned above were both covered by enamel that had a chalky, opaque, lusterless appearance and was soft enough to be scratched with the point of a scalpel. Practically all the enamel of both of these teeth left remains after decalification by Bödecker's method. Celloidin sections of the incisors of rats in which a severe hypoplasia of the enamel had been produced by the addition of sodium fluoride to the diet contain the remains of all the enamel intact as far as the gingival margin, and interrupted remnants even to the incisal edge; whereas, sections of the incisors of normal rats prepared concomitantly contain remains of enamel only on the deep quarter of the incisors. In the normal incisors, the remnants of enamel stain as do primary, young and transitional enamel. In the incisors with hypoplastic enamel, these same phases are represented basally, but most of the remains from the deep eighth of the tooth toward the cutting edge take the deep basic stain of the early transitional phase of enamel maturation.

SUMMARY AND CONCLUSIONS

1. Human enamel normally undergoes a process of maturation that is completed approximately three months after its initial deposition by the ameloblasts.

2. The process of maturation is divisible into four phases, which coincide with the phases that were demonstrated polariscopically by von Ebner, and are called primary, young, transitional and hard enamel.

3. Primary, young, and transitional enamel are relatively insoluble and are easily retained in sections of decalcified teeth, where their decalcified remains differ in staining reactions. Hard enamel is readily soluble and does not leave remains after decalcification.

4. When enamel more than 3 months old is considered, the proportion of teeth from which a residuum of enamel is left after decalcification is the same in each of the first five decades of enamel age.

5. Three months subsequent to its deposition by the ameloblasts, the enamel undergoes no further change that affects its solubility during technical processes of decalcification.

6. Remains of enamel that are found in sections of decalcified teeth represent enamel that has been incompletely matured.

7. Hypoplastic enamel contains a high proportion of incompletely matured enamel, which is usually in the transitional phase of maturation.

EMBRASURE SADDLE CLASP—ITS PRINCIPLE AND DESIGN*

By M. M. DeVAN, D.D.S., Philadelphia, Pa.

THE "seed" of the idea embodied in the embrasure saddle clasp is contained in the Roach bar design[1]; the "plant" will be observed to be quite dissimilar. The design to be presented here is the result of a continuous effort to retain the advantages of the Roach bar clasp while eliminating its undesirable features.

Clasping drawbacks that have been responsible for branding a partial denture as the "uncomfortable corridor" that leads shortly to a full denture have, in this design, either been eliminated or at least attenuated. When combined with a two-dimensional occlusal form, it is destined to render full denture prosthesis less and less imperative.

There is more in the embrasure saddle clasp to commend it than is apparent to the eye. A discussion of the principles involved in clasping will therefore be necessary before an exposition of its design.

CLASSIFICATION OF CLASPS

Prothero[2] made an astute observation when he described the crown of a bicuspid

*Read before the Section on Partial Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

1. Roach, F. E.: Principles and Essentials of Bar Clasp Partial Dentures, J.A.D.A., 17: 124 (Jan.) 1930.

2. Prothero, J. H.: Prosthetic Dentistry, Chicago: 1904, Medico-Dental Publishing Co., p. 250.

or molar as having an occlusal cone and a cervical cone. "The form of the crown of a bicuspid or molar tooth usually represents sections of two more or less regular cones, reversed, the bases of which meet in a common plane passing through the greatest buccolingual diameter."

In considering the foregoing concept and that of Dr. Stone, whose work will be discussed later, it occurred to me that all prevailing clasp designs could be placed in one of two major groups: (*a*) the suprabulge design, and (*b*) the infrabulge design.

More scientific terms could be coined, yet I doubt that they would be so descriptive or comprehensive to the average man. The first includes the circumferential diagonal and horizontal clasps; the second, the Roach bar and the embrasure saddle designs.

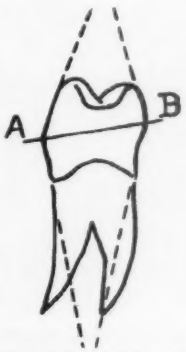

Fig. 1.—Prothero's concept of bicuspid as having occlusal cone and cervical cone, line *AB* representing their base. All undercut planes are located on the cervical cone. With a suprabulge design, the surfaces of the cone above *AB* must be traversed in order to reach the undercut planes.

With the suprabulge design, the clasp arm approaches the plane of undercut from above, traversing the occlusal cone. The infrabulge approaches the plane of undercut from below, coming up from the region of the gingiva. Direction is reckoned with the cast in hand and not as seen in the mouth.

SUPRABULGE DESIGN

Prior to the introduction of the Roach bar clasp, all prevailing clasps were suprabulge in design. The clasp arm traversing the occlusal cone engaged the undercut from a level above it. The earliest clasps were of the horizontal type without occlusal rests, used merely as a retainer. Teeth were employed not as abutments but as anchorages. Whenever an occlusal rest is used, the term abutment tooth rather than anchorage tooth is preferable; for the tooth not only retains and anchors, but also supports as an abutment.

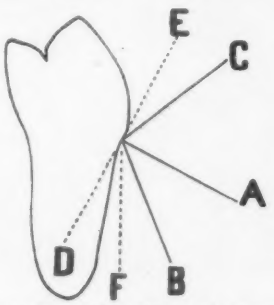

Fig. 2.—Angle of incidence of clasp arm to undercut plane. The line *ED*, representing the undercut plane, would present the greatest resistance to traction if the clasp arm bore the relationship of line *A*. Lines *C* and *B* would offer less resistance, while line *F* (being nearly parallel with *ED*) would offer the least resistance. Line *C* is representative of a suprabulge, while *B* is representative of an infrabulge design. A dislodging force would be more effectively resisted by *B* than by *C* because of the tripping action evoked by the former. (After Stone.)

With the advent of the cast clasp and especially of the one-piece casting, clasp design became more and more diagonal, the clasp arm traversing the lingual and

buccal surfaces from the occlusal rest and harnessing their undercuts.

Nothing so simple and compact as the diagonal clasp would have been put aside for the more complicated and spread-out Roach bar clasp if the former did not possess shortcomings and the latter promise marked advantages. And if I read the trend of the times correctly, nothing so nearly unique as the Roach bar clasp would be waning in popularity with a return to the circumferential design, if experience did not reveal radical shortcomings.

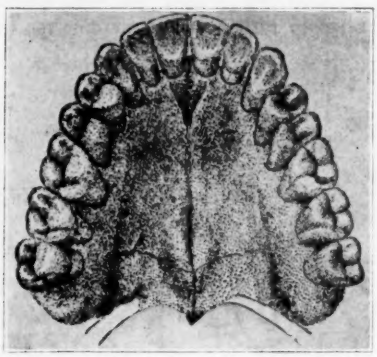

Fig. 3.—Divergence of maxillary teeth, rendering utilization of buccolingual undercuts of any opposite pair inseparable from clasps that lack snugness as to their respective abutments. (After Black.)

There are two major difficulties with the Roach design: 1. The outspreading clasp bars create many hazards to distortion. During the finishing up process, great vigilance is required if the appliance is not to leave one's grasp. In cleaning the denture, much care is likewise demanded of the patient. 2. Difficulty will be experienced in effecting a contact of clasp bars with the mucosa and at the same time avoiding impingement. To insure against irritation, a slight relief is most generally resorted to. These in turn favor food impaction; which renders the denture annoying unless it is immediately removed after eating and cleaned.

What is the major difficulty with the diagonal clasp? It is, I think, that experienced in effecting a terminal seating of the appliance. A partial denture is finally and absolutely seated only when all the occlusal rests (without pressure or recoil) make a perfect contact with their respective abutment teeth.

This is not easy. Considering the "variables" inseparable from the routine construction of cast partial dentures, it is far from a surety that the occlusal rest and clasp arms will be found in

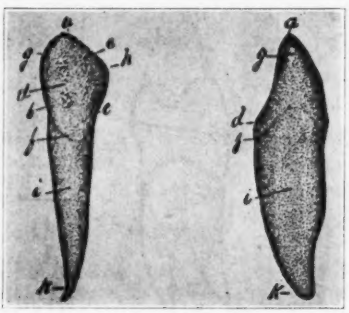

Fig. 4.—Left mandibular cuspid. The only effective undercut is located on the distal surface. Such a tooth can be successfully employed as a retainer with the embrasure-saddle design wherein the undercut plane of the proximal surface adjoining the saddle is utilized. There is an absence of undercut planes on the buccolingual surfaces. While molars and bicuspids possess buccolingual undercut planes, they are invariably inferior to those found on the distal and mesial surfaces. (After Black.)

harmonious contact with the tortuous surfaces that they traverse. The problem is further complicated by the not infrequent lack of parallelism. As a rule, the abutment teeth of the maxillary arch show a divergence, while those in the mandible tend to converge, i. e., at the

level of the occlusal surfaces, a line uniting the central axes of any two maxillary abutments of opposite sides will be found to be longer than the line connecting their central axes at the level of their cervices. The reverse is true of the abutments of the mandible. The usual outcome is that the appliance has a slight "give" or "spring" when masticatory stresses are placed on it.

This recoil may be so slight that the prosthetist is not aware of it, and even the patient may conclude that it is inherent in an appliance that partly "rests on the gums." Under these circumstances, the abutment teeth continue to receive a steady stream of unfavorable flexional and tortional stresses.

Fig. 5.—Occlusal cone coverage of two basic clasp designs outlined on molars. The infrabulge design (right) avoids the occlusal cone except at two points, the primary and reciprocal rests. The suprabulge design (left), owing to its greater coverage, is more likely to present greater interference to the final seating of the appliance. Nonaxial stresses are likewise enhanced with an increase of occlusal cone coverage.

Generally, there exists a differential in resiliency between the lingual and buccal clasp arms. In the presence of a force sufficient to evoke the spring of the stouter arm, the abutment tooth suffers displacement in the direction of the more resilient clasp arm.

The circumferential clasp and especially the diagonal has another drawback in that it increases the occlusal contour of the abutment tooth. It does this not only by traversing the occlusal cone, but also by filling in the occlusal approach to the interproximal embrasures. This added occlusal convexity does much to augment the resistance offered to the bolus of food. Hugh W. MacMillan has drawn attention to the fact that surfaces do not have to be in actual contact to be in functional contact. Interposition of a bolus will cause these surfaces to transmit stresses in the direction of their inclination.

When a masticatory apparatus has been impaired to the point of requiring a partial denture, a sharp lookout for stress attenuation should be made. Convexity as well as contacts ought to be reduced, and not augmented as they are with circumferential clasps. Furthermore, every attempt should be made to render applied forces axial in direction. We may fill in with substitutes the places vacated by the natural teeth, but we are impotent to restore the status prior to the loss. The damage in a real sense is irreparable and final, for the number of buttresses have been forever reduced. A program of stress reduction under these circumstances is beneficial. Our endeavor should be similar to a surgeon's: not to effect the normal state, but rather a com-

Fig. 6.—Embrasure-saddle design. The arm of the clasp is contiguous with the pontic tooth, occupying the interproximal embrasure. The bearing area of the abutment is the undercut plane of the proximal surface adjoining the pontic.

fortable working state wherein what remains is preserved.

The horizontal clasp has this advantage over the diagonal; it does not cause the alteration of occlusal contour. Its drawback is that it is not so close fitting as the diagonal, favoring food impaction. This lack of snugness is also generally annoying to the enveloping soft tissue organs, especially the tongue.

To reiterate: The covering up of any portion of the occlusal cone with clasp arms is undesirable, as these surfaces may not only interfere with the ultimate seating of the appliance, but also, when stressed, transmit nonaxial forces to the abutment teeth.

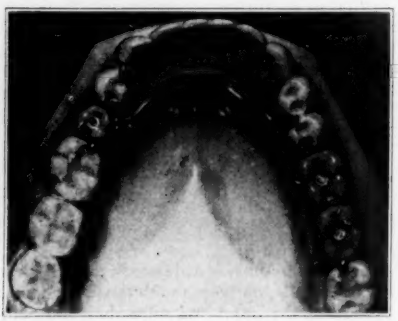

Fig. 7.—Occlusal view of case shown in Figure 6. There are no lingual clasp arms. With the embrasure-saddle design, undercut planes are so effectively harnessed that, with bilateral appliances, each clasp unit consists of a single clasp arm with two occlusal rests.

Finally, flexibility with the circumferential design, especially the diagonal, is oftentimes short of adequacy, the elastic limit of the alloy being more nearly approached, oftentimes fracture or failure in retention resulting, owing to deformation.

INFRABULGE DESIGN

Too much praise is not possible for men possessed of the courage and sagacity to part with traditional concepts and explore new fields. Dr. Roach has done for clasp design what Victor H. Sears did for tooth design. The introduction of the bar clasp and the first of the nonanatomic posterior teeth marks a new epoch in the history of prosthesis. The designs involved in both have changed and will continue to change, but the principles back of them are fundamental. They are destined to influence future prosthetic practice more than many believe possible.

E. R. Stone, in a scholarly treatise[3] on clasp action, has observed two important factors in retention: (*a*) the angle of incidence of clasp arm to undercut plane, and (*b*) the tripping action evoked during clasp traction.

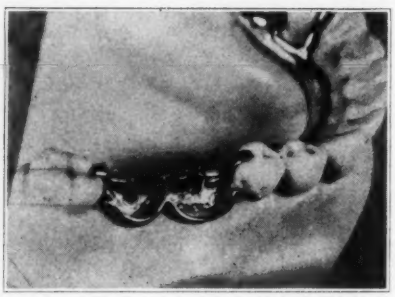

Fig. 8.—Sectional view of case shown in Figures 6-7, prior to cementation of pontic teeth. The clasp arm arises from the intersection of the two pontics.

The observation of these factors required acumen, and the able exposition of them in the paper mentioned merits a careful reading by every student of the subject.

It is no disparagement to Dr. Roach to state that these two factors operating saliently in his infrabulge design were not clearly perceived by him. At least,

3. Stone, E. R.: Tripping Action of Clasp, D. Cosmos, 74:960 (Oct.) 1932.

there is no mention of them in his paper. Many others besides myself sensed greater retention with the Roach design. We were even vaguely aware that the abutment teeth fared better in comfort. Dr. Stone's work was needed to make it clear that a suprabulge design is not comparable to an infrabulge design in its retentive aspect.

ANGLE OF INCIDENCE

The maximum in retention for a given undercut plane is possible only when the clasp arm approaches the plane of undercut at right angles. If we reduce this angle, we reduce the resistance to traction. At a zero angulation, where the clasp arm is parallel to the undercut plane, we have only to overcome the force of friction to effect traction.

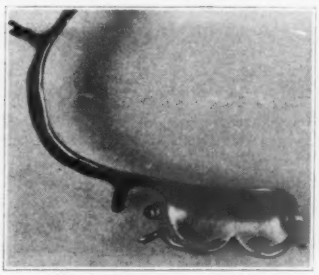

Fig. 9.—Saddle view of case shown in Figures 6-8, prior to cementation of pontic teeth. There is a millimeter of separation between the body and the clasp. The porcelain pontic fills in this separation; which renders the clasp arm contiguous with it.

This factor can be explained by a law in mechanics the essence of which is that a surface can counteract the entire magnitude of an applied force only when the force falls perpendicularly to it. Any other angulation will result in a component of force parallel to the surface, a component which has only to overcome the force of friction to travel unopposed.

It is implied, of course, in the foregoing statement that the object whose surface is stressed is capable of reacting to the original force applied at right angles without a measurable change in its state of motion or shape. It should also be stated that the final force may be the resultant of several forces the direction of which was not originally perpendicular. This matters not as long as the final resultant falls at right angles.

Dr. Roach has made the profession aware of an important fact in tooth morphology; namely, that the most decided undercuts are located on the proximal surfaces. When an undercut plane on the proximal portion of the cervical cone is approached by a clasp arm that comes up from the gingiva, the usual result is an angulation close enough to a right angle to render slipping difficult.

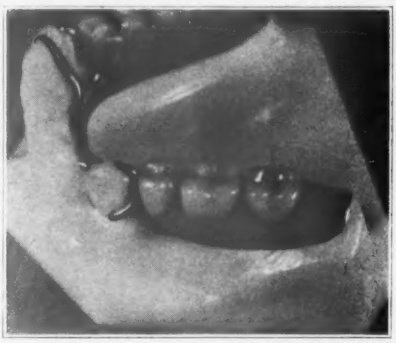

Fig. 10.—Embrasure-saddle clasp with teeth attached with vinyl resin. This combination is a favorite of the author, as the result is a light esthetic appliance.

The suprabulge horizontal and diagonal clasps utilize less decided undercuts of the buccal and lingual surfaces. When this fact is combined with another; namely, that their clasp arms are more nearly parallel to the undercuts which

they engage, it is not surprising to find divorcement on slight provocation.

TRIPPING ACTION

Tripping action is obvious, yet is difficult to define. The best way to demonstrate it is to push and pull a fountain pen having a short blunt nib across a supported writing pad. As the angle of the pen to the pad approaches a right angle, we receive a tactile sensation of tripping during the act of pushing. This vibratory trip is entirely absent while the pen is pulled across the pad. The foregoing experiment is most valuable, for we not only feel and see tripping action, but

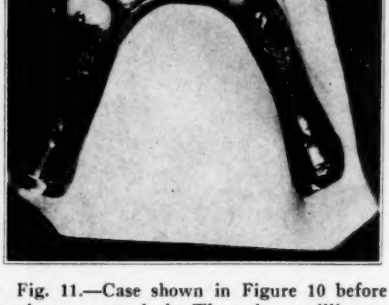

Fig. 11.—Case shown in Figure 10 before teeth were attached. There is a millimeter of separation between the saddle and the clasp arm. It is possible to alter the resiliency of the clasp arm after the casting is made. If, during the trying in, it is discovered that more spring is necessary, the clasp arm can be increased by disking with a fine wheel stone. If the resiliency is too great for the desired retention, the clasp arm may be shortened by placing a little mat gold in the separation, followed by solder.

also our pad bears a graphic chart of it. The push lines will reveal at regular periodic intervals heavier markings indicative of periodic flexures of the shoulders of the pen's nib. The lighter lines uniting these dashes indicate intervals of release when the pent-up energy in these resilient flexions is suddenly made available to effect motion.

The result of pulling the pen across the pad regardless of angulation will be an unbroken line of like intensity.

This clasp and pen analogy is a happy one, for they possess similar precious metal parts: resilient shoulders or arms, tips or bearing points.

The writing pad was employed in order to observe and analyze tripping action in general. It is obvious, of course, that its rough penetrable surface is not comparable to the smooth impenetrable enamel surface. In fact, if a lubricated glass slab were substituted for the pad,

Fig. 12.—Embrasure-saddle clasp utilizing maxillary first incisor as abutment.

tripping action would be entirely absent, regardless of angulation or direction of traction.

It thus becomes apparent that if tripping action occurs in the mouth, and one feels that something of the sort occurs, there must be another factor besides the angle of incidence to account for it. This factor will be found to be the tortuosity of the surface of traction.

To summarize what we have thus far observed: Tripping action can occur on a penetrable plane; an impenetrable surface must be in more than one plane to evoke it.

In the mouth, the action as we find it

while pushing is a single trip flexure and release, not a series of them as seen in the tripping chart. It would therefore be more precise to label it "trip action" rather than "tripping action," for the latter implies a series of repeated cycles.

TRIP ACTION ANALYZED

A minimum of force is required to spring a tapered clasp arm when the force is applied at the extreme end, at right angles to its long axis. As the direction of force application becomes parallel to the long axis, more and more force will be needed to effect the same degree of flexure.

While pulling across a bulge, the side of the bearing point is stressed, the necessary flexure being thus secured with a minimum of force. If we are pushing across a bulge, flexure requires more force, for the tendency is to stress the end of the bearing point.

Again, traction is more facile in pulling over the tooth bulge, because the flexure of the clasp arm is such as to reduce the angle of incidence. During pushing, traction is rendered more difficult, for the flexure involved has a tendency to increase the angle of incidence.

TRIP ACTION IN SUPRABULGE AND INFRABULGE DESIGNS

Trip action is evoked in inserting an appliance after the suprabulge pattern, such as the diagonal clasp. It is entirely absent when such a denture is removed. With the infrabulge design, the reverse is true-trip action, which is manifest on removal and absent during insertion. As trip action is an obstacle to traction, an infrabulge clasp will better resist dislodging forces during mastication.

THE EMBRASURE SADDLE CLASP

The embrasure saddle clasp, as its name implies, is an infrabulge design, the clasp arms of which are contiguous with the saddle or pontic tooth and occupy the interproximal embrasure. Retention is secured by harnessing the abutment undercuts located on the proximal surface adjoining the saddle.

With bilateral appliances, an embrasure saddle clasp consists of a single clasp arm with two occlusal rests. Substituted for the usual lingual clasp arm is a reciprocal rest placed at the lingual "break" in the marginal ridge of the opposite proximal surface. This secondary or reciprocal rest is connected with the main body of the denture by a stout upright that occupies the lingual embrasure.

The primary occlusal rest is placed as far buccally as possible, the reciprocal occlusal rest as far lingually as possible. This gives us a rest adjoining each proximal surface, and they are so situated lingually and buccally that movement of the abutment tooth at right angles to its long axis is discouraged. I am indebted to Clyde H. Schuyler for the suggestion that added stability results from placing the primary occlusal rest at the extreme buccal end of the marginal ridge.

Being of infrabulge design, the occlusal cone of the abutment tooth is left untraversed and practically unaltered in contour. The occupation of the occlusal approach to the lingual interproximal embrasure by the connecting upright of the reciprocal rest is to be looked on as a demerit when compared with the Roach bar design. The elimination of the troublesome lingual clasp arm more than compensates for this slight increase in occlusal contour.

ADVANTAGES OF THE SINGLE-ARM CLASP OVER THE DOUBLE-ARM CLASP

We have been in the habit of thinking that a buccal undercut requires a lingual undercut to retain a clasp on an abutment. Yet a little thought will make

obvious the fact that in principle anchorage depends on locking a clasp against an undercut plane. The utilization of more than one plane merely serves to increase retention rather than to provide it. As far as the welfare and comfort of the abutment tooth is concerned, the utilization of a single undercut is more advantageous.

Walter Chappelle has something very pertinent to say about this point:

> The varying flexibility of opposing clasp arms is another source of trouble. Variations in bulk and variation in adjustment may give one arm more force than another. We have no way of measuring the force. An alternative safeguard is to have the bearing on one side of the tooth rigid, or nearly so, and the bearing on the other side sufficient only to lock the tooth in this bearing. Soreness or a sense of uncomfortable pressure does not come from rigidity or severity of clasp grip, but rather from unequally opposed bearing or degree of force resulting from disturbing torque.[4]

The observation that embrasure saddle abutments are quite free of tenderness or soreness might in part be due to its single-arm clasp design. For the possibility of torque, caused by a differential in resiliency of opposing clasp arms, is entirely eliminated.

Again, many a partial denture has proved a failure because of tongue irritation. The elimination of the lingual clasp arm will do much to give to removable appliances the tongue comfort inherent in fixed dentures.

SUPERIORITY OF PROXIMAL UNDERCUTS

A further word should be said about the advantages of undercut planes found on the mesial and distal surfaces over those located on the buccal and lingual surfaces. Not only are their convexities more pronounced, but also their location in the middle third of abutment teeth near the axial angles renders them more nearly immune to dental caries. Buccolingual undercut planes on the other hand have less convexity and are located at the cervical third, an area well known for its high susceptibility.

The superiority of proximal bearings is not limited to each individual unit. A fact of utmost clinical importance is that proximal undercuts can be paired with little difficulty. A mesial undercut plane of one side is very apt to be parallel with a mesial undercut plane of an abutment on the other side. This is also true of any two distal undercut planes of opposite sides.

The usual divergence of maxillary abutments of opposite sides or the usual convergence of mandibular abutments of opposite sides renders the utilization of a pair of opposite buccolingual undercuts inseparable from clasp arms that lack snugness and compactness to their respective abutments. The frequent outcome is tongue discomfort and annoying food traps.

Finally, practical experience has made certain the fact that with the embrasure saddle design proximal undercut planes do not interfere with one another. In the region of the axial angles, any two can be successfully combined.

COMPACTNESS AND SNUGNESS

The terms "compactness" and "snugness" are not synonomous in the sense that I employ them. A clasp is compact when its parts are few and close to the main body of the denture. It is snug when it closely hugs the abutment tooth or mucosa with no projecting parts. Compactness of design can be observed with the appliance in one's hand; snugness, on the other hand, can be detected only when the partial denture is in the mouth or on the master model.

4. Chappelle, Walter: Partial Denture Design, D. Cosmos, 75:188 (Feb.) 1934.

Compactness of design is desirable, for it reduces the likelihood of extra-oral mishaps resulting in bent parts, and it is more pleasing to the eye. It is of psychologic importance to note that a denture is in the hand prior to its being in the mouth. Anything that increases its eye appeal will help to minimize the all-too-natural aversion to removable appliances. It was the search for an infrabulge design that possessed compactness and snugness that was responsible for the evolution of the embrasure saddle design. What could be more compact than a clasp arm contiguous with the pontic tooth or a saddle harnessing the adjoining proximal undercut? Clasp distortion is not only less likely, for it is supported lingually or occlusally, but also it can be seen extra-orally whether the clasp arm bears the proper relationship to the rest of the denture.

Snugness has been achieved in this clasp design by the elimination of the lingual clasp arm, and the utilization of the undercut plane of the proximal surface adjoining the saddle. When the proximal surface remote from the saddle is employed, it becomes necessary to traverse either the "coronal bulge" or the "mucosal bulge" of the abutment tooth. With the circumferential clasp, the former is crossed; with the Roach bar, the latter is crossed. The term "mucosal bulge" is employed to designate the usual bony prominence of the external alveolar plate in the region of bicuspid and molar teeth.

In order to traverse the mucosa at these levels, it is usually necessary (if we are to avoid impingement) to relieve the impression; which results in a loss of snugness. Snugness concerns itself with mucosal as well as coronal intimacy and its nonexistence results in the annoyance of soft tissue organs and food traps.

When we fully consider the tension characteristic of life today, and especially among those who have the means to acquire gold partial dentures, we will leave no stone unturned to provide the factor responsible for tongue and cheek comfort; namely, snugness of design. Again, the amenities of life can be more smoothly discharged when one is not annoyed after every meal until one's denture is removed and cleaned.

ADVANTAGES OF UNDERCUT PLANES FACING THE SADDLE

We have discussed the compact and snug design incident to the use of proximal undercuts adjoining the saddle. We also touched on the loss of these desirable features when remote proximal undercuts are employed. Let us now record other advantages resulting from the use of these nearby undercut planes:

1. There is no dental papilla to contend with. Usually, there is sufficient loss of interdental septum adjoining the saddle so that soft tissue impingement is not likely to be encountered in utilizing the interproximal embrasure.

2. There is more favorable stress transmission. Where other teeth adjoin the abutment tooth, the application of force in their direction is desirable. Thus, during removal and insertion of the appliance, the abutment tooth is favorably steadied by adjoining teeth. When the remote proximal undercut is employed, the direction of force is toward the least supported side of the abutment; for the proximal side of an abutment adjacent to the alveolar ridge will usually be found to be banked with less bone than the side adjoining another tooth. This sharing of stress is not present when buccolingual undercuts are used, for a force applied on the buccal or lingual surface must be borne by the abutment tooth unaided by the adjoining teeth.

3. There is greater retention. By a

fortunate coincidence, the undercut plane facing the saddle is liable to be more nearly perpendicular to the long axis of a clasp arm that arises from the periphery of the saddle or pontic tooth. It thus becomes unnecessary to introduce bends or wrists to the clasp arm to increase retention. A single-arm clasp for each abutment will suffice to retain the appliance because of this right angle relation. Resistance to traction under these circumstances is very great.

STRESSES SUSTAINED BY THE ABUTMENT

A study of the stresses applied through this clasp design will reveal them to be essentially axial in direction. In fact, the embrasure saddle clasp transmits to its abutment tooth less nonaxial stresses than any other known clasp. Nonaxial pressure emanates through bearings on the sides of the abutment tooth. With the exception of an undercut plane and the bearing of the "upright of the reciprocal rest," vertical surfaces are avoided. The location and inclination of the two occlusal rests near and at right angles to the central axis assure the transmission of favorable axial pressure. Its single-arm clasp eliminates the possibility of torque due to a variation in flexibility of opposing clasp arms. If the appliance lacks terminal seating when first inserted, it is not likely that it will continue to do so. A slight shift of the abutment tooth will assure ultimate occlusal rest contacts. For with the occlusal cone untraversed and the sides of the abutment sparingly used, no obstacle causing a slight spring could long remain.

AUXILIARY RESTS ON AUXILIARY ABUTMENTS

It may be argued that by permitting the sides of the abutment tooth to go free, we lose much in stability. But I maintain that an abutment tooth in retaining an appliance and supporting it at two points is doing all it can safely do. Other teeth in the arch should be utilized through occlusal rests in the lingual embrasures. Such teeth could be designated as "auxiliary abutments" and such rests as "auxiliary rests." A tooth that has lost one or both of its adjoining teeth should not be looked on as a robust tooth. Yet such teeth, because of their location adjoining the saddle, are clasped into service, while we permit teeth buttressed on both sides to go unemployed. It is also well to keep in mind that leverage intensifies "saddle stresses" to abutment teeth.

CONCLUSION

Three procedures will do much to give permanency in partial denture restorations: (1) the use of the single-arm embrasure saddle clasp; (2) the generous use of auxiliary abutments, and (3) the attenuation of nonaxial stresses through two-dimensional occlusal forms.

More than a decade of persistent thought has led me to the conclusion that one should be wary in rendering a patient edentulous, and that functional limitations are inexorably inherent in full dentures. Skill and sagacity can minimize but not eradicate them; for these shortcomings are due to the nature of the edentulous support and the means of attachment to this support. The preservation of a few teeth to serve as buttresses of a partial denture may present troublesome restorative problems yet when results are compared with those associated with a full denture resting on a displaceable membrane, one feels more than justified for having made the effort.

4002 Chestnut Street.

RATIONALIZING THE ANGLE-SIMON METHODS*

By RICHARD LOWY, D.D.S., Newark, N. J.

DR. ANGLE'S latest appliance, namely the edgewise arch, in certain respects approaches nearly the ideal appliance, permitting practically all types of tooth, crown and root movements, and performing these various movements simultaneously or individually.

Since I have been associated with Ralph Waldron, who is one of the leading Simon exponents in this country, this appliance had a decided appeal to me, because it was a so-called three-dimensional appliance, which could be linked with Simon's three-dimensional diagnosis.

The philosophy of the mechanism of this appliance has been thoroughly discussed and explained by Drs. Waldron, Strang, Brodie, Noyes and others. A review of the component parts is essential. The alinement bracket band consists of a strip of gold platinum band material 1¾ inches long, ⅛ inch wide and 0.004 inch thick, to the central point of which is soldered a solid piece of metal. The bracket has a slot cut horizontally for the perfect reception of the 22 by 28 edgewise arch.

The winglike projections are for the reception of ligature wire, which secures the arch wire in the slot. The little gold staples are auxiliaries used in combination with the tie brackets on teeth that require rotation, made of No. 4 wire of 0.15 inch size.

The minute washers 0.025 inch in thickness fit accurately over the 0.022 by 0.028 arch wire, when stops are soldered to the arch mesiad from the molar tube. The washer then may be used to extend the arch wire.

Nichrome wire as a ligature is far superior to the original brass ligature. The wire may be procured in various sizes, 0.008, 0.010 and 0.012, and, if annealed, pulls the arch wire into position easily.

Last but not least are the 22 by 28 edgewise arch and the round smaller gage wires. (Fig. 1.)

The mechanics of the appliance will be explained under treatment.

B. E. Lischer, in his textbook "Orthodontics," sums up the underlying philosophy of orthodontia as follows:

1. What is the nature and extent of the abnormality to be corrected?

2. What is the condition to be established?

3. What movements will be necessary?

4. What method of treatment will best accomplish these movements?

A careful study of these four points will convince the student that the last two are valueless if the first two are incorrectly determined.

Until 1924, Angle's classification had been the basis of orthodontic diagnosis. Angle maintained that, since the maxillary jaw was fixed, it would be less susceptible to malocclusion. Hence, his theory of the constancy of the first molar. He states in his book that "for convenience two points have been selected to note variations from the normal in the

*Read before the Section on Orthodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

arches—mesiobuccal cusp of the upper first molar, with the buccal groove of the lower first molar."

He took into consideration only the sagittal relation of the teeth. He also overlooked the fact that the deciduous denture was not always correct and since the maxillary first molar erupts distad from the second deciduous molar, it too

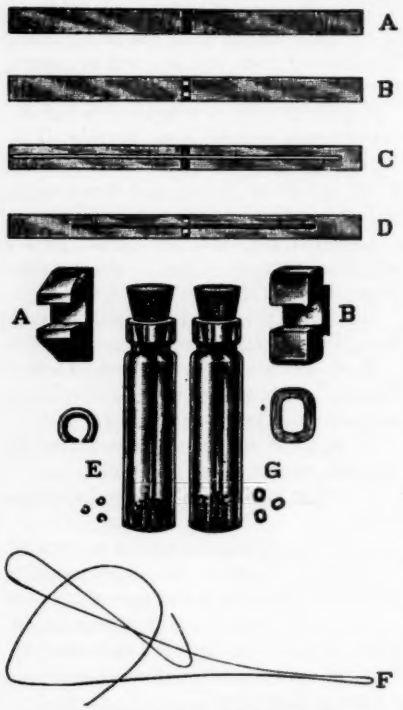

Fig. 1.—Component parts of Angle edgewise appliance. *A*, alinement bracket. *B*, edgewise bracket. *C*, 22 by 28 edgewise arch in bracket band. *D*, 0.022 round arch in bracket band. *E*, staple for rotations. *G*, washers. *F*, ligature wire.

may have drifted mesially. This has, in the past, undoubtedly accounted for many of our failures in the treatment of Class 2 cases; i.e., the maxillary molars had drifted forward, whereas the mandibular molars were in correct position. This also explains why, in two apparently similar cases, one responds and the other is a failure.

Though Angle's classification is based on the constancy of the first molars and is a fiction, credit and honor should be accorded him because he took orthodontia out of chaos and gave it a starting point. There is nothing to be said against this fiction in a practical way of thinking, as long as there is no better fiction.

Paul Simon realized that our problem was biologic and not mathematical. He recognized the fact that we were dealing with dento-facial deformities, including not only the teeth and alveolar process, but frequently the jaws. No longer should we base our diagnosis on an isolated pair of models of the teeth, but should orient them to the skull as a whole.

Thus, we see that if diagnosis is to point the way to intelligent treatment in any given case, it must reveal the difference between the existing denture of the patient and the condition to be established.

The exact procedure of making a diagnosis rests upon cephalometric principles; that is to say, the teeth are not studied and measured in themselves only, but in their relation to the head and to themselves. Since it is impractical to make all the measurements on the living, we resort to two kinds of reproductions, one the gnathostatic model and the other the photostatic transcription.

In order to make the definition of the difference between normal and abnormal with more certainty than is possible by a mere examination of models, Simon made use of the so-called curve diagnosis. Certain of the features observed by the use of that method of diagnosis are:

1. Distance from median plane.

(a) Transverse symmetry.
(b) Arch form.
(c) Proportion of width.
(d) Axis of tooth inclination.
2. Distance from orbital plane.
(a) Sagittal symmetry.
(b) Degree of prognathism.
(c) Axis of tooth inclination.
3. Distance from eye-ear plane.
(a) Distance between it and occlusal plane.
(b) Angle between it and occlusal plane.
4. Photostat.
(a) Degree of prognathism or retraction.

Simon computed his so-called "norm" by utilizing a standard method of recording cases and computing a satisfactory mean, then compared an orthodontic case with the norm based upon normal averages.

Dr. Simon has computed a norm for adults. Dr. Lischer now has completed three norms at the University of California; namely, for ages 4, 6 and 9.

The third and fourth points are then made easy because the diagnosis has clarified and brought all existing conditions to the attention of the orthodontist.

In order that both the mechanics of the edgewise arch and diagnosis may be

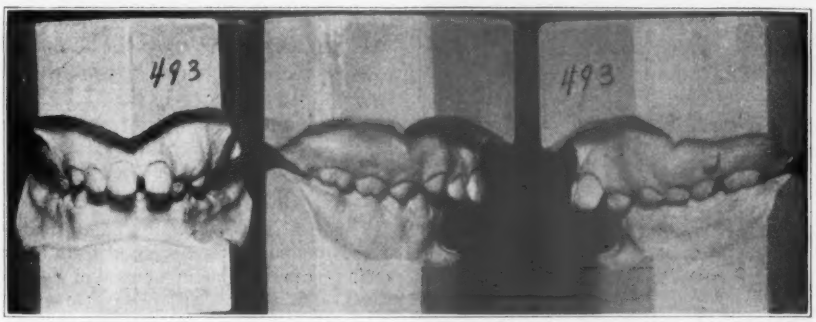

Fig. 2.—Gnathostatic model of patient V. R. Left: Front view. Center: Right side. Right: Left side.

(b) Face form and symmetry.

Thus, we see that a three-plane orientation is a fundamental condition for comprehensive study. We must show the relation between the normal denture and the three cranial points.

We come now to Dr. Lischer's second point; namely, what is the condition we wish to establish?

The orthodontist needs to visualize a normal denture, for every treatment has the object of giving the patient a similar one. In reality, no ideal denture has ever been seen because it does not exist. Our conception is based upon a fiction. discussed coincidentally, I shall illustrate it practically. (Figs. 2-4.)

In the case of Miss V. R., the gnathostatic and photostatic diagnosis presents a mild symmetrical dental alveolar contraction of both the maxillary and the mandibular arches, also a maxillary incisal dental alveolar protraction, plus a medium dental alveolar retraction; whereas, the relation of the denture to the horizontal plane showed a maxillary incisal alveolar abstraction, plus a total alveolar attraction. All of which means that (1) the arches needed width; (2) the incisal area of the upper needed to be

brought back; (3) the mandibular teeth must be brought forward but the mandible must not be moved, and (4) though the incisal teeth appear elongated and this condition is diagnosed as an abstraction, one must bear in mind the forward and downward development of the maxillary arch. The curve of Spee causing the deep overbite must be corrected.

If teeth must be alined, arches widened, teeth moved mesially and distally, what appliance permits almost simultaneous movement?

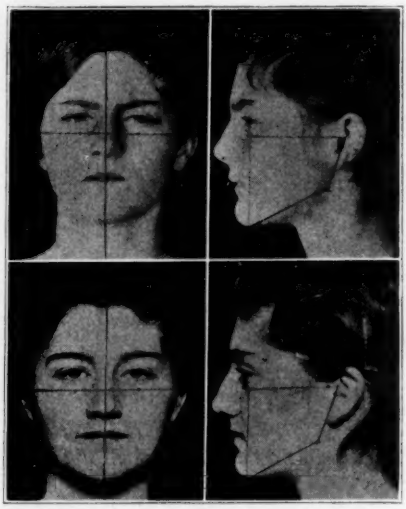

Fig. 3.—Photostat of V. R. Above: Before treatment. Below: After treatment.

The new Angle edgewise arch method is the only one that I know of which will assure all the movements being made simultaneously. Note the word "simultaneously": I know that this case can be treated with many other types of appliances. (Fig. 5.)

It must be borne in mind that the efficiency of this appliance is dependent among other things on the bracket engagement of all teeth. Therefore, this case was originally started with a modified Mershon lingual appliance. When all the permanent teeth had erupted, the new Angle mechanism was used.

In order to ensure proper movement of teeth with a minimum loss of efficiency, the soldering of the molar tube is of vast importance. (Fig. 6.) It must be parallel to the occlusal surface and at right angles to the buccal surface. The former prevents mesial or distal tipping of the molar tooth and depressing or elevating of the anterior teeth when not indicated. The latter prevents the uncontrolled torquing of molar teeth, because controlled.

If the arches and teeth are to be expanded, the use of torque for individual teeth is recommended. (Fig. 7.) This is accomplished by putting a tortional twist in the arch at the point to be torqued. In a paper read in Chicago in February, Ralph Waldron said:

> Thus we can see that torque as applied here is nothing but a tipping of teeth from their vertical position in a buccal or lingual direction requiring two steps, first the torque, and secondly the detorque.

When an increased width is required, torque is an unnecessary movement, because the expansion can be very simply accomplished with the use of a modified lingual arch wire as illustrated in Figure 8. This is made by soldering a piece of platinum gold wire 0.50 at right angles to the lingual surface of the molar band on which fits a small tube whose external diameter measures 0.090 and 0.065 mm. This ring fits snugly over the round post. (Fig. 9.) The tube is soldered to an 0.036 lingual arch wire. The locking of this appliance is accomplished by ligation with a piece of "wipla" from the lingual aspect to a small ring on the buccal surface of the molar band, and is augmented by a spur soldered to the lingual surface of the right and left first bicuspid bands, which help to

hold the lingual arch wire up to its work.

With this type of lingual arch, the second order of tooth movement is not inhibited, and the axial angle changes and buccal movement can be accomplished simultaneously.

the necessary elevations, depressions or axial modifications demanded for proper correction of the case will be produced. The bands must be placed in the middle third of the tooth. On teeth that do not

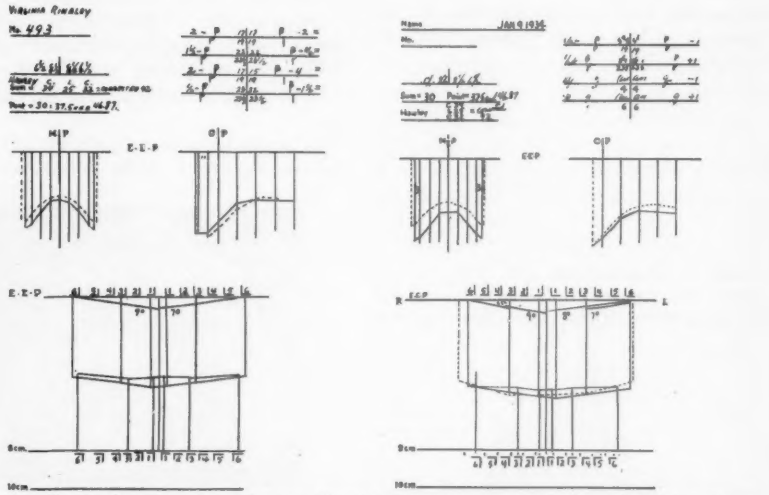

Fig. 4.—Graph showing change in case illustrated in Figures 2-3. Left: Original condition. Right: Condition after treatment.

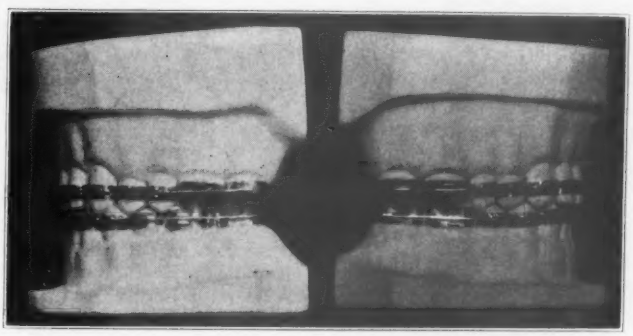

Fig. 5.—Appliance used in treatment of case of V. R.

The next important step is correct positioning of the brackets. (Fig. 10.) This is of importance because when the 22 by 28 arch wire is seated within the brackets, require rotation, the bracket should be centered and in the direction of the long axis of the tooth.

Returning for a moment to the diag-

nosis, we can readily see that by proper alinement of bands and with the use of a light 0.020 round arch and gradually stepping up to a 22 by 28, the excessive curve of Spee can be eliminated.

Thus by having all the brackets on a plane, the teeth can be elevated or depressed or the axial relation changed without difficulty.

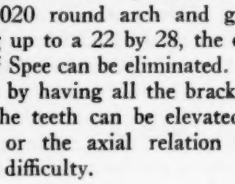

Fig. 6.—Washers on arch wire between molar tube and stop soldered to arch. The correct position of the molar tube is shown.

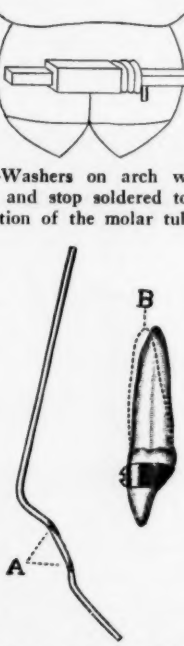

Fig. 7.—Use of torque.

As for rotations (Fig. 11.), Dr. Strang in his book of orthodontia says:

In teeth requiring rotation the bracket is frequently off centered, its position depending upon that of the tooth on which it is adjusted. On broad teeth like maxillary central incisors, it should be shifted to the side against which pressure must be exerted by the arch wire to carry this section lingually as the tooth rotates. It will then act as the fulcrum for that portion of the arch wire that is to be used as the rotating lever. On the opposite edge of the labial or buccal aspect of the band is placed a staple for the application of the ligature that is to set the arch wire lever in action.

The next step of importance is the shaping of the labial arch wire. Here again I quote from Dr. Waldron's paper, "The Edgewise Arch and Tie Bracket Bands in the Treatment of Malocclusion":

In shaping the metal arch (Fig. 12), I measure the width of the incisors, and the cuspid teeth, and to this I add 0.010 inch, which represents the thickness of the band when cemented in position. I then mark off on the piece of 0.022 by 0.028 elastic gold material, the width of the central incisor, the lateral incisor and the cuspid, plus 0.010 inch additional for each tooth, then I mark the position of the labial ridge of the cuspid, and proceed to bend the arch as described by Angle, using a Hawley arch chart as a guide, for a more symmetrically formed arch wire as shown in Figure 12, right, a drawing selected by Dr. Angle as representing the ideal arrangement of teeth

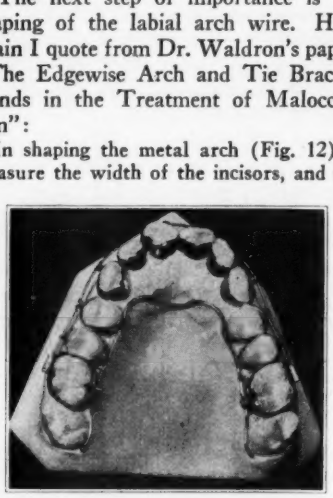

Fig. 8.—Appliance used in case of V. R., showing lingual arch in place.

Fig. 9.—Construction of tilting lingual arch.

in a fairly average normal maxillary denture, upon which is superimposed a Hawley chart of 0.096 size. You will see how closely it approximates the ideal arch form of Angle.

Figure 12, left, the same drawing with a Hawley chart of 104 size superimposed on it, shows how closely the metal arch will conform to Angle's ideally formed arch wire, and is about four sizes larger than the Hawley arch predetermination for this case.

With this symmetrically formed arch wire as a base, I proceed to widen, narrow and modify its shape to conform to my own preconceived idea of what the arch form for this particular case should be.

For narrow dentures, I am guided some-

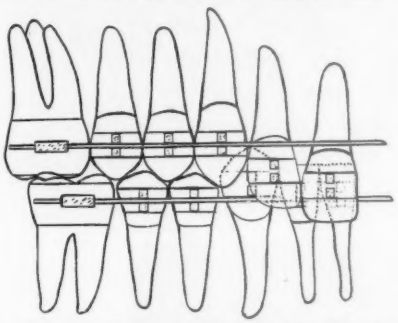

Fig. 10.—Correct positioning of brackets for necessary elevation or depression.

what by the Hawley arch form, and for wider cases by the Pont index, not necessarily adhering very closely to either, but using judgment, always considering the typal patterns of the teeth as the prime factor, then the type of the face and skull and the general type of the individual, which I think is the method most in use as a guide in determining arch form at present. But I have hopes that in the near future we will have a more comprehensive guide than we now have.

Thus, in this case. the arch wire is made up to a 0.092 Hawley for the maxillary teeth and an 0.080 for the mandibular teeth.

One of the many features of this type appliance is the fact that by proper alinement of bands, a change of inclination of teeth is made possible.

When an orthodontist examines two ordinary models and states that the molars and bicuspids are in a mesial or distal inclination, he bases his diagnosis on what might be called the "All American Hunch." In order to determine the position of any object, it is essential that its position be oriented from some point in a plane. Therefore, with the use of a gnathostatic model, one can determine the inclination of teeth from the frontal, median and ear-eye plane.

Thus, with the proper means of diagnosis and the correct application of force, the end-result is simplified, because, as previously stated, mesial or distal tipping of crowns and roots is obtained.

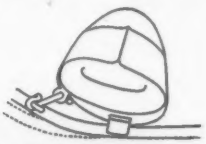

Fig. 11.—Use of staples for rotation.

In order to accomplish this tooth movement, the arch is adjusted, when in position to bind in the brackets and exert the necessary directional force. (Fig. 13.)

I quote from Dr. Angle's article, "The Latest and Best in Orthodontic Mechanism":

> In addition to the required movements of the first order, all the teeth need tipping into their correct position of uprightness. This is effected by adjusting the metal arch in such a manner as to cause it, when seated, to bind in the brackets and sheaths and to exert power favorable to this end.
>
> It is obvious that if the arch lay passively within the brackets and sheaths, no force would be exerted or tooth movement effected. But it will be equally clear that if, before seating it in its attachments, it were

nosis, we can readily see that by proper alinement of bands and with the use of a light 0.020 round arch and gradually stepping up to a 22 by 28, the excessive curve of Spee can be eliminated.

Thus by having all the brackets on a plane, the teeth can be elevated or depressed or the axial relation changed without difficulty.

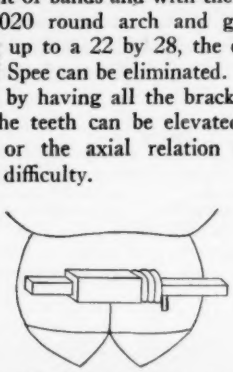

Fig. 6.—Washers on arch wire between molar tube and stop soldered to arch. The correct position of the molar tube is shown.

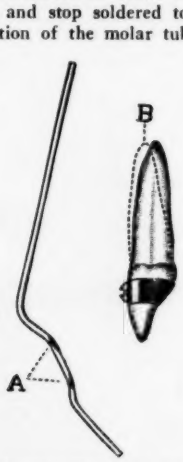

Fig. 7.—Use of torque.

As for rotations (Fig. 11.), Dr. Strang in his book of orthodontia says:

In teeth requiring rotation the bracket is frequently off centered, its position depending upon that of the tooth on which it is adjusted. On broad teeth like maxillary central incisors, it should be shifted to the side against which pressure must be exerted by the arch wire to carry this section lingually as the tooth rotates. It will then act as the fulcrum for that portion of the arch wire that is to be used as the rotating lever. On the opposite edge of the labial or buccal aspect of the band is placed a staple for the application of the ligature that is to set the arch wire lever in action.

The next step of importance is the shaping of the labial arch wire. Here again I quote from Dr. Waldron's paper, "The Edgewise Arch and Tie Bracket Bands in the Treatment of Malocclusion":

In shaping the metal arch (Fig. 12), I measure the width of the incisors, and the cuspid teeth, and to this I add 0.010 inch, which represents the thickness of the band when cemented in position. I then mark off on the piece of 0.022 by 0.028 elastic gold material, the width of the central incisor, the lateral incisor and the cuspid, plus 0.010 inch additional for each tooth, then I mark the position of the labial ridge of the cuspid, and proceed to bend the arch as described by Angle, using a Hawley arch chart as a guide, for a more symmetrically formed arch wire as shown in Figure 12, right, a drawing selected by Dr. Angle as representing the ideal arrangement of teeth

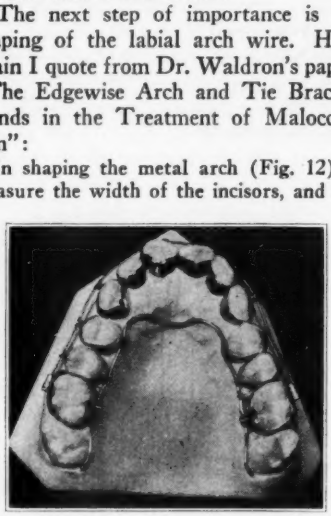

Fig. 8.—Appliance used in case of V. R., showing lingual arch in place.

Fig. 9.—Construction of tilting lingual arch.

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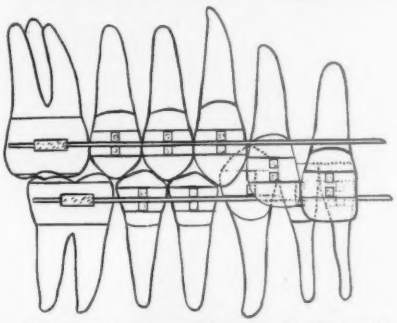

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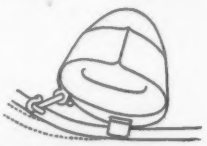

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given two very slight equal vertical bends in opposite directions for each tooth, that is, one gingivally anterior to each bracket and sheaths, and one, occlusally posterior to each bracket, the result would be that, when seated, those portions that lie within the slots of the brackets and in the sheaths would be slightly oblique to the long axis of the metal arch. Therefore, in placing it in position on the teeth, it would require

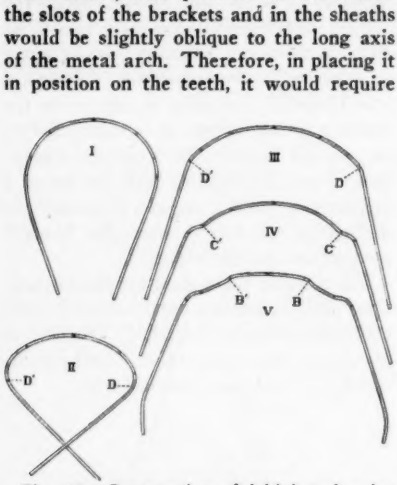

Fig. 12.—Construction of labial arch wire according to Angle.

We should not lose sight of the fact that bracket engagement of all teeth is a prime requisite in this order of tooth movement. Therefore, before resorting to the second order bends, a case should be of necessity started with light round arches 0.018 and gradually stepped up to the 0.020-0.022 and finally the 0.022 by 0.028 edgewise arch.

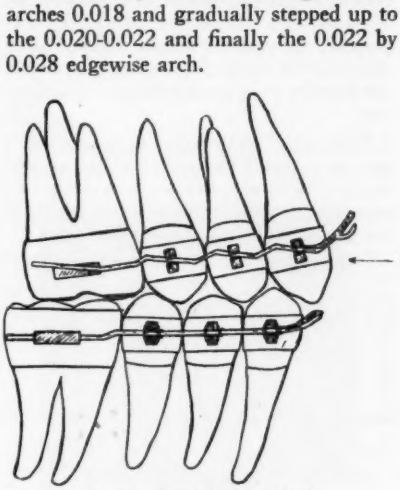

Fig. 14.—Second order bends.

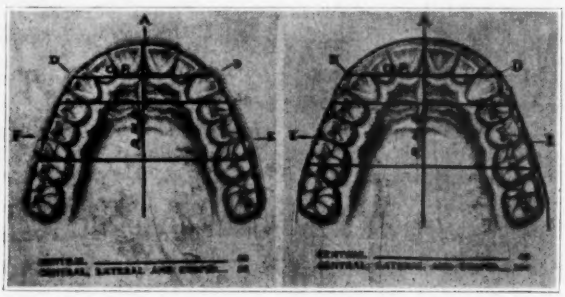

Fig. 13.—Left: Drawing selected by Angle as representing ideal arrangement of teeth with a Hawley chart 0.096 size superimposed. Right: Drawing shown at left, but with a Hawley chart 104 size superimposed.

to be sprung into its attachments, when it would bind within the walls of all of them, prying gingivally on the distal end of the gingival wall and occlusally on the mesial end of the occlusal wall of each bracket and sheath.

The use of intermaxillary elastics in conjunction with the so-called picket fence is of tremendous importance. It must be realized that when the necessary bends have been made and the

arch wire is in the molar tubes, the anterior section lays gingivally from the incisal brackets and when ligated into position would tend to depress the maxillary incisor. The use of intermaxillary elastics overcomes this force. Secondly, with the distal tipping of the crown, the root moves in the opposite direction; whereas, the elastic force prevents too great an undesirable root movement.

the arch wire in front of the mesial end of the molar tube.

Figures 15-16 show the final result of the case used in illustrating some of the salient points (separation between teeth, due to the thickness of the bands). Spaces can be closed with light arch wire.

CONCLUSION

It must be thoroughly understood that although Angle has constructed a wonderful appliance capable of producing all necessary tooth movements, the appliance is by no means automatic. To any one further interested I suggest the reading and study of R. W. Strang's "Text Book of Orthodontia."

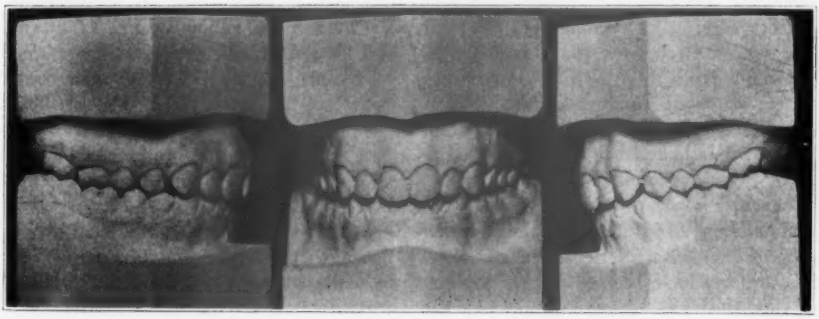

Fig. 15.—Completed case.

Fig. 16.—Comparison of maxillary arches.

Naturally, one other point is the use of the original principle of Baker anchorage; namely, the forward stimuli given to the mandible and teeth.

It also must be noted that after teeth are in contact, a spur must be soldered to

DECLINE OF THE HUMAN DENTITION

By M. RUSSELL STEIN, D.D.S., New York City

THERE is much discussion today in scientific circles about the decadence of the human masticatory apparatus. Anthropologists are seriously concerned with the questionable future of man's teeth. They have become conscience of the genetic decline of the human dentition and, from their writings, one senses a fear of rapid destruction instead of a slow gradual process of degeneration. Some fundamental phylogenetic changes have been appreciated for many years. The chief cause of alarm has been the rampant spread of the most prevalent disease of civilized man, dental caries. Four major facts have been offered in support of the theory of degeneration: (1) the diminution in the length of the dental arch; (2) the frequency of impacted third molars; (3) the prevalence of dental decay and pyorrhea, and (4) the tendency to malformation of the arches and to malocclusion.

The human dental machine is degenerating, but I do not believe that the second, third and fourth reasons are any evidence of that breakdown. I therefore cannót share the opinion of Prof. Earnest Hooten that "the increase of dental disease and degeneration may ultimately cause the extinction of the human species." Nor do I agree with Prof. Adolph Schultz that, because he found caries, impactions and periodontoclasia in his series of anthropoid skulls, the human dentition is not degenerating.

Dental disease could hardly cause the extinction of the human race because it neither disturbs nor alters the continuity of the germ plasm. Caries is quite unimportant in the reproduction of mankind, as parents with bad teeth can rear large families. With well-constructed artificial dentures, civilized man can thrive without his natural teeth. Daniel E. Ziskin, of Columbia University, is of the opinion that, with the proper diet, man could even get along without the artificial teeth. He observes that some of the chief benefits of plates in toothless persons are esthetic, the preservation of the vertical space between the upper and lower jaws.

W. K. Gregory has noted that where special diet has been assumed, many races of mammals have survived with degenerate dentitions, e.g., numerous forms of edentates and cetacea.

Fortunately, each dental disease that man is heir to is not necessarily a herald of destruction. There are certain criteria for true phylogenetic morphologic degeneration. The new character or form must be definitely inferior to the old one, the inferiority being mechanical, physiologic, chemical, immunologic, etc., as long as the new type is less efficient than its antecedent. This new condition must be inheritable. If it cannot be passed on from parent to offspring, it is no evidence of genetic decadence.

Man is a short-jawed primate. Even long-jawed human variants are short-jawed as compared with the apes. The retrusion of the human masticatory apparatus is correlated with the encephalization of motor functions and the consequent development of the brain. Just how or why the whole complex of

changes came about is really not so clear as is sometimes thought. As compared with those of any of his anthropoid relatives, man's jaws and muscles of mastication are weaker. The teeth are smaller and mechanical efficiency has been lost through the proportional increase in the width of the dental apparatus consequent to the expansion of the cranium. The intercondylar width in man has increased at the expense of the vertical muscular components.

Harry Shapiro, of the American Museum of Natural History, was recently quoted as predicting that, although the weight and height of man will probably continue to increase, the dental arches will become smaller. This forecast is consistent with the known facts. The reduction of tooth and arch size is a character satisfying the above-named criteria for degeneration. As such, it does not seriously impair the mastication of graham crackers and chicken croquets. Even on his sporadic returns to nature at Sunday picnics, man is hardly apt to display his manliness or rather his "apeliness," in ripping the bark off a sapling by drawing it between his teeth. It may be true that the dental mechanism is becoming smaller and weaker, but its duties are correspondingly lightened.

Before impaction of molars is included in the same category as the characteristic just discussed, its distribution and etiology should be considered. It seems logical that if the anteroposterior dimension of the dental arch were diminished, there would be less room for third molars and hence for impaction. But among civilized peoples, impaction abounds; while among primitives, it is rare. Many Melanesians have larger third molars than our first molars, yet they erupt with room to spare. Furthermore, the phylogenetic reduction in the length of the arch has been accompanied by a proportional reduction in the size of the teeth. Space alone is not the sole determining factor of eruption. In some persons, the bone metabolism is such that a tooth would erupt completely outside the line of the dental arch if there were no room for it. Their lower third molars grow out of the ramus, and the upper out of the plate of the alveolus. In others, even when there is plenty of room, the teeth are sluggish in eruption. There is little doubt that these symptoms are partly due to insufficient function during the periods of active bone growth in the early years of life. Impaction of teeth may be just another toll of the tender diet of civilized man. No one has as yet conclusively demonstrated that impaction is an inherited condition. It is therefore not a vanguard of destruction.

Hardly a civilized person today is immune from dental decay. Irrespective of age, sex, wealth or social position, it ravages the mouths of millions, while the dental profession helplessly stands by without a vaccine, without an antitoxin and with too little money for research.

Early investigators discovered that the acid of decomposing food which caught in fissures and in between the teeth disintegrates the enamel structure. Lately, there has been conclusively demonstrated a systemic susceptibility to caries which is intimately linked with metabolic disturbances. There are now two separate schools: one upholds the theory of local causes and claims that a clean tooth never decays; the other believes in systemic immunity.

Only recently, champions of each school debated the issue. Some facts conceded by both sides were not debatable. Primitive people living rugged lives have sound teeth. They rarely have impactions, caries or pyorrhea. Eskimos eat raw meat. Their women, we are told, chew the men's boots. Their dentitions are enviable. They use their teeth till

they are worn down to the gums. Polynesians living on vegetables and fish have sturdy teeth, and so have those nomadic Mongolians who live mostly on dairy products. Diets differ, but they all have in common the primitive living conditions and vigorous function.

Leuman Waugh has made some noteworthy observations on his trips to Labrador. The effect of white man's civilization on Eskimos with perfect teeth within one generation is disastrous. Dr. Waugh brought home casts of the mouths of older natives who were born and reared in primitive surroundings, and of the younger generation which had early contact with the white traders. The latter were living museums of oral disease.

Many Europeans who had emigrated to America arrived with sturdy dentitions, only to be the ready victims of the use of white bread, breakfast cereals and napoleons. If, in a civilized society, whether through the use of soft diet or because of other unnatural living conditions, the dentition is rendered susceptible to caries, decay, too, is not a sign of genetic degeneration.

The question of the inheritance of malocclusion is unsettled. Types of bites are inherited. Some of these, because they do not approach the dentist's conception of some hypothetical "normal occlusion" are regarded as malocclusion. Natural variations of arch forms are wide, and one must be careful to distinguish them from postnatal afflictions. Whatever the solution of the problem, the fact remains that malocclusion by far predominates in civilized communities. And no matter how skilful the orthodontist, the brace rarely stimulates bone growth and moves teeth to the position which they would naturally have taken had our address been New Britain instead of New England.

Prior to a discussion of those characters which do satisfy the two criteria of inferiority and inheritability, we must consider the unique biologic rôle of man's denture as a nonadaptive organ, for teeth an uncommon situation in nature.

Teeth have played an important part in mammalian evolution. In man's prehuman ancestors, they were still on the adaptive side of the determinative scale in natural selection, as evinced by dental divergence in the primate order. The precise time when teeth shifted from an adaptive to a nonadaptive rôle is relatively unimportant.

When our arboreal ancestor dropped from the lowest branch of the tree to abandon his aerial domicile and take up housekeeping on terra firma, evolutionary changes were accelerated by the new mode of life. When he picked up his first club as a weapon, the teeth were exempt from their military duties. When he roasted his first steak over his primitive hearth, he started a custom which ultimately sealed the doom of dentition, that is, genetically speaking. Deprived of such vigorous function, the teeth lost their survival value.

Evolution by natural selection is a progressive correlation of form and function. After the dentition of man ceased to be influential in selection because of the rising importance of other organs, its structure did not remain the same. Whereas, at one time, disadvantageous mutation might have been ruled out in a life and death struggle against the elements and enemies, they were permitted to remain, that is, provided they were not ontogenetically lethal. Dental changes of the last million years are largely nonadaptive. Generally, dentitions are genetically conservative, and hence the release of selective control resulted not so much in a divergency of forms as in a dedifferentiation of theretofore differentiated parts. W. K. Gregory has aptly referred to this condition as polyisomerism (many simi-

lar parts), secondary polyisomerism, to be more accurate, because of the primary dental polyisomerism present in our very remote piscatorial ancestors.

Gregory's concept of polyisomerism is a landmark in evolutionary theory. It is specifically applicable to the history of not only teeth, but also the entire animal body. He has shown paleontologic evidence of the transition of forms of many families from a primary polyisomerism to anisomerism (differentiation) and thence in some cases back to a state of secondary polyisomerism (dedifferentiation). This is a striking parallel to the evolution of the human teeth. The recognition of this phylogenetic metamorphosis throws an interesting light on some evolutionary histories.

Those phenomena which do satisfy the criteria for degeneration are of two types, the loss of specialized form and the reduction in size. The division between the two categories is neither sharp nor immutable. Nearly all the teeth show both.

The most obvious difference between anthropoid and human dentures is the proportional sizes relative to the entire skull. The human denture is smaller.

Then there is the dedifferentiation of the cuspid. The crown of the upper cuspid is longer than that of any other tooth in all primates except man, in whom it is usually exceeded in length by the upper central incisor. The root is the longest even in man. The cuspid of the gorilla is a powerfully developed stabber. In the lemur, it is a long slender flattened blade. In man, it has been reduced to about the size of the central incisor. In addition, the central and cuspid have acquired the same anatomic features. As was first pointed out by Harrison Allen (1874) and later by G. V. Black (1897), these teeth have the same number of primary parts, or developmental lobes, three labial and one lingual.

Furthermore, the same basic design is shared by the bicuspids. The historic observation of G. V. Black is worth quoting here: "The bicuspids, though unlike the incisors and cuspids in the contour of their crowns, have the same number, and similar distribution of primary parts, or lobes. They are, indeed, formed on the same general plan. The change of form is a result of a different relative development of the parts." This illustrates Gregory's concept of polyisomerism. From an evolutionary viewpoint, this particular linkage of anterior and posterior teeth by a common basic design is a comparatively recent development. From it, some anatomists have inferred the development of the bicuspid from the incisor.

There are analogous parts of the bicuspid and molar groups, such as the lingual cusp of the upper bicuspids and the mesiolingual cusp of the upper molars. There exists a similar analogy between the lingual cusps of the lower second bicuspid and the lower first molar.

Through the loss of differentiating features, the teeth of man are becoming more alike. They are converging in form. Although some of the teeth are more conservative than others, there is a general tendency for all to acquire characteristics of an adjacent or nearly differentiated tooth. Not only approximating teeth, but also widely separated teeth, show convergence of form. Some of the varied forms of upper third molars are so similar to second bicuspids that if it were not for the roots, they could not be distinguished. They correspond cusp for cusp, ridge for ridge and groove for groove. Not only does this convergence occur between different groups of the same jaw, but also between members of the opposing jaws. The upper cuspid has the same basic design as the lower first bicuspid.

Diminutive forms of different teeth tend to the same conical pattern. The

similarity between the diminutive forms of the upper third molar and the lower first bicuspid is striking. The peg-shaped lateral incisor is in the same class.

The trilobulation of the labial surfaces of the anterior teeth and buccal surfaces of the bicuspids and of all the cusps of the posterior teeth is the most outstanding mark of secondary polyisomerism in the human dentition. There is no tooth in the jaws of man which does not bear the stamp of this all-prevailing dominant characteristic.

Further evidence of degeneration is the reduction of the number of cusps and the simplification of the crown patterns of the molar teeth. This is accompanied by a marked segmentation of the crown into cusp units or lobes. Nowhere in the primate order are the occlusal surfaces of the posterior teeth so sharply divided by grooves into distinct cusp areas as in man. The grooves are referred as as developmental lines. In man, this feature is so marked that the coalescence of the lobes at the developmental lines frequently fails, leaving fissures, deep clefts in the enamel, which too frequently reach the dentin, creating a perfect portal of entry for infection. Perhaps genetic segmentation and the consequent tendency to fissures are factors in dental decay.

Finally, we come to missing teeth, a phenomenon determined mainly by heredity. They are in no way related to function, as is pointedly illustrated by the curious fact that Labrador Eskimos, with broad, well-developed jaws, and fine, sturdy teeth, often have diminutive, or an absence of, third molars. The absence of teeth is not so serious as some of the other changes. Dr. Gregory writes: "Certain mammals in past ages have lost the third upper molars and yet have persisted to today, e.g., bears, dogs and cats. Marmosets have lost their upper and lower third molars."

In the light of the foregoing facts, I offer the following outline of genetic changes going on in the human dentition:

1. Diminution in the proportional size and length of the dental arch.
2. Dedifferentiation—the general tendency to convergence of tooth forms to common, simple nonadaptive patterns.
3. Segmentation.
4. The high percentage of diminutive and missing teeth.

One may therefore rest assured that the chances of human annihilation by dental decadence are very slight in both the immediate and the far-distant future.

THE DENTAL SURGEON IN RELATION TO THE PREVENTION AND CURE OF CANCER*

By GEORGE E. PFAHLER,† M.D., Sc.D., Philadelphia, Pa.

CANCER of the lip and mouth is one of the most horrible types of this lesion with which we have to deal. It is repulsive, painful and distressing, not only to the patient but also to all those with whom he associates. It inter-

*Abridged from an illustrated lecture given before the Pennsylvania Association of Dental Surgeons, Philadelphia, Oct. 9, 1934.

†Professor of Radiology, Graduate School of Medicine of the University of Pennsylvania; Chairman, Committee on Cancer Control, Philadelphia County Medical Society; Chairman, Commission on Cancer, Pennsylvania State Medical Society.

feres with the pleasures of life, and with the intake of food and drink.

Each year, about 4,000 people in the United States die from this type of cancer. In my opinion, most of these cancers could have been cured if treated skilfully, thoroughly and promptly, at the beginning of the disease, and probably most of them could have been prevented. The American Society for the Control of Cancer has definitely placed upon the dental surgeon the responsibility for preventing and detecting intra-oral malignant disease.

Bloodgood has said that a beautiful woman never develops cancer of the skin or mouth. The reason for this is that a beautiful woman is very particular to have any blemish on her skin or any lesion within the mouth treated immediately, not perhaps because she fears cancer, but because she wants her skin and mouth perfect.

It is generally recognized that cancer never begins in normal or healthy tissue. There is always some defect or unhealthy condition preceding its development. Therefore, as far as we can recognize unhealthy conditions, and can correct these unhealthy conditions, we should be able to prevent cancer. Fortunately, the lip and the mouth are very sensitive portions of the body, evidencing to the patient symptoms of disease at the very beginning, and they can be examined easily by both the patient and the dental surgeon or physician. The dental surgeon is more apt to see the patient early with some soreness about the mouth than is the physician. Therefore, the prevention of cancer is primarily a function of the dental surgeon.

Through a long period of instruction, by word of mouth, which is best of all, by radio and literature, the public has been educated to "see their dentist at least twice a year." They have been furthermore educated to see their dentist when any symptoms develop about the mouth. Therefore, if we can add to this alertness on the part of the patient, a corresponding alertness on the part of the dental surgeon, surely many cases of cancer about the lip and mouth can be prevented. The children are now being educated to have their teeth examined at regular intervals. The teeth are being inspected in the schools. Therefore, the habit of care of the teeth is being developed at an early stage. This should do much for the prevention of cancer, if the dental profession and the medical profession will do everything individually to restore tissue to normal.

LESIONS OF THE LIP TO BE OBSERVED BY THE DENTAL SURGEON

In the ordinary course of a routine dental examination of the mouth, the dental surgeon can observe any fissure, crust, scaling, warty growth, persistent "fever blister" or a slowly healing wound, all of which are conditions which either precede cancer or are an early evidence of cancer. All can be eliminated. In the hands of an expert, such tissues can be restored to a healthy condition, and thereby many cancers of the lip can be prevented or recognized in an early stage, when 97 per cent of them can be cured. With increased skill and thoroughness, it is hoped that all can be cured.

INTRA-ORAL CANCER

In like manner, the dental surgeon in his routine examinations will recognize jagged or sharp-edged teeth. These may be sharp-edged because of an actual necrosis present, or they may be simply worn down so that sharp edges catch the cheek or irritate the tongue in the ordinary process of mastication. It has been my opinion, and I believe it can be borne out by careful examination, that when-

ever a patient bites the cheek, there is a sharp-edged tooth which catches the mucous membrane just long enough to hold it and bring about biting. These sharp edges may also result from a filling's having dropped out, leaving a sharp edge which may irritate the cheek for a considerable time. The dental surgeon may notice undue irritation from some cause not connected with the teeth, such as chewing tobacco or holding foreign bodies or foreign material in the mouth frequently enough to cause local irritation of the cheek, gum, tongue or lip. I have in mind the habit of carrying pins, nails or tacks in the mouth, or holding a quid of tobacco on the inside of the cheek; or a pyorrheal process which has caused ero-

Fig. 1 (Case 1).—Left: Appearance of patient, aged 67 (referred by Dr. Hanley) Jan. 15, 1925. The patient had had leukoplakia during ten years, and gradually this area became sore. He had smoked excessively forty-five years. The leukoplakia had definitely degenerated into squamous cell carcinoma. Treatment was by radium. Right: Appearance May 8, 1925. The mucous membrane is clear and healthy. The patient has now been well almost ten years. This illustrates the type of case that a dentist should have recognized ten years earlier.

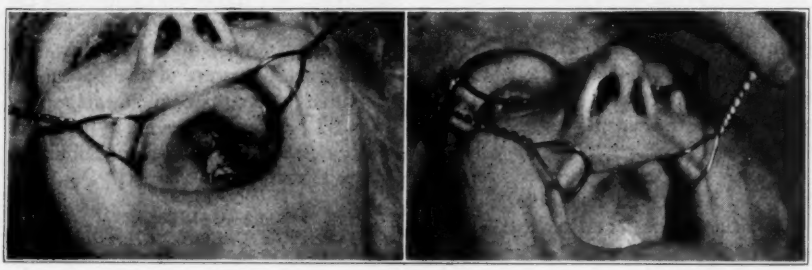

Fig. 2 (Case 2).—Left: Appearance of patient, aged 72, referred (by Dr. Blackwell) Dec. 2, 1927, on account of epithelioma developing upon leukoplakia due to irritation of plate which she had been wearing. As soon as the patient discovered this, she consulted her dentist, who failed to recognize it as a dangerous condition, and cauterized it. This illustrates the inadvisability of cauterizing any doubtful area. The patient was treated by radium applications. Right: Area completely healed, April 2, 1928. The patient has remained well approximately seven years.

sion and chronic inflammation over a long period about the teeth. All of these conditions I have seen preceding or associated with cancer. All can be corrected if observed before cancer develops.

The dental surgeon may observe white patches or leukoplakia on the inside of the cheek, on the tongue or on the lip for a considerable time before cancer develops. This condition comes on slowly, particularly as a result of excessive use of tobacco, but probably is also influenced occasionally by an underlying syphilitic condition. The patient is therefore not apt to consult a physician until these white patches begin to ulcerate, form fissures or take on definite new growth. The dental surgeon may even, long before

Fig. 3 (Case 3).—Left: Appearance of patient, aged 64, referred (by Dr. Wagner) Nov. 24, 1924, on account of epithelioma developing for three years, involving right alveolar process and roof of mouth, and destroying floor of right maxillary sinus, at last causing opacity of right maxillary sinus. The case was treated by radium applications inside the mouth, radium packs on the outside and roentgen-ray treatment on the outside. Right: Lesion healed, May 15, 1925. At this time, the antrum was clear and the floor of the antrum had re-formed. The patient remained well eight years, then died of stomach trouble.

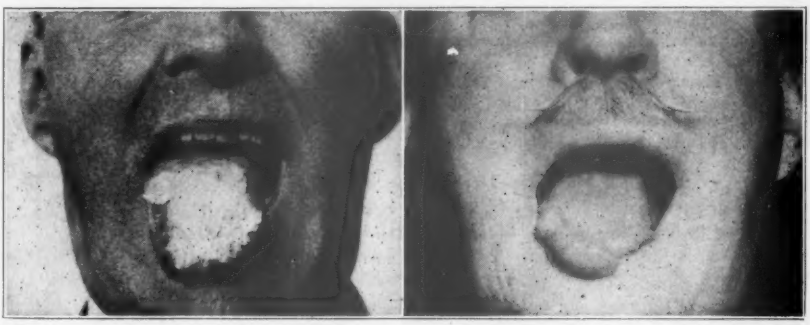

Fig. 4 (Case 4).—Left: Appearance of patient, aged 50, referred (by Dr. Cummins) May 1, 1924, on account of extensive leukoplakia involving entire tongue, associated with fissures and thickening, and found to be definite squamous cell carcinoma. The patient had also enlarged lymph nodes in both submaxillary regions. He had smoked excessively for twenty years. The lesions were treated by both electrocoagulation and radium applications. Right: Lesion healed, Oct. 8, 1931. The patient was well ten years later.

there are any definite patches, recognize a general whiteness or faint milky appearance of the mucous membrane, which with a faint creamy coating, caused by excessive smoking, if the patient will stop smoking or stop the use of chewing to-

TABLE 1.—RESULTS IN THREE HUNDRED AND SIXTEEN CASES OF EPITHELIOMA OF THE LIP

Treatment carried to a conclusion	294
Advanced and hopeless cases in which treatment was not advised	22
Total	316

Classification According to Results of Treatment

	Cases	Per Cent
Patients living and free from evidence of disease (absolute cures in all cases)	240	81
Patients dead from carcinoma	40	13
Patients well when last seen, not traceable now	14	6
Total	294	100

Omitting the fourteen cases not traceable, but probably cured: recovered, 85 per cent; dead, 15 per cent.

Classification According to Extent of Disease

	Recoveries		Dead from Cancer		Total Cases
	Cases	Per Cent	Cases	Per Cent	
Local lesion, 1.5 cm. or less in diameter	159	98	3	2	162
Local lesion, extensive, i.e., more than 1.5 cm. in diameter	53	79	14	21	67
Cases in which there were palpable lymph nodes	25	53	22	47	47
Postoperative irradiation given before recurrence	3	75	1	25	4
Total	240		40		280
Cases with no palpable lymph nodes	212	92	17	8	229
Cases with palpable lymph nodes	25	53	22	47	47

Cases Treated Prior to Jan. 1, 1929

	Well	Well Over 5 Years	Dead from Carcinoma	Lip Well* Dead from Intercurrent Disease	Not Traced	Total
	Cases	Per Cent				
Local lesions less than 1.5 cm. diameter	107	97.2	3	13	4	127
Extensive lesion (more than 1.5 cm. diameter)	25	75.7	8	9	2	44
Cases with palpable lymph nodes	7	26.8	19	4	1	31
Total						202

*Not included in percentages.

indicates excessive use of tobacco and is a danger signal. At this early stage, when the mucous membrane is simply covered bacco, and make use of an alkaline mouth wash, ordinarily he will recover without any other special treatment. If leuko-

plakia patches have definitely formed, they usually require local destruction, together with local radium applications. When once these white patches show thickening, one must consider the possibility of cancer, and it will be better if such a case is seen by one who is expert in the diagnosis and treatment of cancer.

When ulceration develops about the mouth, or when any sore develops which lasts more than two weeks, one may already be dealing with cancer, and the subject should then be considered quite seriously. The patient should be seen by an expert. It is not advisable to make frequent applications of nitrate of silver. In fact, if one has in mind the possibility of cancer, no nitrate of silver nor any caustic should be applied, as it only destroys the surface and causes congestion

TABLE 2.—RESULTS IN CASES TREATED BY PREVIOUS AND BY PRESENT TECHNIC*

Total treated by previous methods	181
Total treated by present technic	264
Total mouth cases treated	445
Total lip cases treated	294
Total	739

Treated by Previous Methods

	Well	Absolute 5 Year Recoveries, Per Cent	Dead from Carcinoma	Dead from Intercurrent Disease	Not Traceable
Tongue	27	28.5	53	4	11
Cheek	9	28.1	20	2	1
Tonsil	5	35.7	8	0	1
Lower jaw	1	5.3	13	2	3
Palate and pharynx	2	9.5	13	1	5
Total	44	24.3	107	9	21

Treated by Present Technic

	Well 5 Years	Well 3 Years	Well Less Than 3 Years	Absolute 5 Year Recoveries Per Cent	Absolute 3 Year Recoveries Per Cent	Dead from Carcinoma	Dead from Intercurrent Disease	Not Traceable
Tongue	16	5	6	26.2	25.0	76	1	2
Cheek	7	10	5	35.0	44.7	16	3	3
Tonsil	2	2	6	20.0	22.2	14	0	3
Lower jaw	6	3	2	25.0	27.2	22	4	2
Palate and pharynx	9	6	3	30.0	35.7	25	4	1
Total	40	26	22=88	27.6	30.6	153	12	11

*Excluding patients who could not be traced and who died of intercurrent disease, there were 30.7 per cent 5 year recoveries under present technic, and 33.8 per cent 3 year recoveries under present technic.

The list of 5 year recoveries refers only to those cases which had been treated more than 5 years ago. The 3 year recoveries refer only to those treated more than 3 years ago, and the others refer to those treated less than 3 years ago.

deeper in the tissues; which leads to a further and more rapid development of the cancer. I have seen cancers that gave a history of long-repeated applications of nitrate of silver, and while I have been unable to state what the conditions were at the beginning of the applications, my impression has been that the nitrate of silver, by its continued irritation, has been a factor in the production of the cancer.

"Oral hygiene is the keystone in the arch of oral cancer prevention." As Solomon has said: "The term 'oral hygiene' does not mean merely brushing the teeth and using mouthwashes, but embraces a much more comprehensive field. In addition to the regular cleaning of the teeth and massage of the gums, it means proper diet and periodic visits to the dental office for prophylaxis and examination."

One must aim at the removal of every form of chronic irritation and inflammation, whether it be mechanical, bacteriologic, chemical, thermal or of any other type. Generally, such irritation must be present for a considerable time, usually months, and perhaps years, before it will actually cause cancer, but certainly the earlier it is eliminated, the more likely is one to succeed in preventing cancer.

Solomon says further,

> The failure to have teeth replaced with artificial substitutes causes several abnormalities in oral function. Irritation of the mucous membrane can result from food fibers packing in the edentulous spaces. Adjacent teeth are allowed to tip and assume improper masticatory stresses which, if continued for even a short time, in some cases may cause trouble. People who have lost the posterior teeth often develop cracks and fissures at the corners of the mouth, due to inability to prevent saliva from seeping from the mouth at these points. Such lesions do not heal well and often become chronic in nature.

I have observed these conditions. The irritation about the angle of the mouth is usually diagnosed as eczema, and generally receives little or no attention on the part of the patient until it becomes painful or until it has actually developed into cancer. The absence of the posterior teeth also causes an increased irritation from attempting to hold the food around the front teeth during the process of mastication, and may cause local irritation. We must urge that absent teeth be replaced by some mechanical appliance, best fitted to the case; but, in this connection, let me urge again that each of you not only pay particular attention to the fitting of these teeth for the time being, but also warn the patient that the mouth may change its shape, while the plate that you make for it does not change. Therefore, after a time, this plate may become irritating, when it must be either adjusted or replaced. I have seen numerous cases of cancer of the mouth following continued irritation from a plate that had long ceased to fit

TABLE 3.—ORAL CASES WITH PALPABLE LYMPH NODES

211 cases: 45 (21.3 per cent) well for varying periods.	
77 cases treated prior to 1924 (old technic): 13 or 16.8 per cent 5 year recoveries.	
55 cases treated between 1924 and 1929 (newer technic): 15 or 27.2 per cent 5 year recoveries.	
Enlarged nodes in and about which radium needles were inserted from 4 to 7 days: 24 cases, in which 10 patients are living and apparently well for periods of from less than 1 year (1 case), 1 to 2 years (3 cases), 2 to 3 years (3 cases), 3 to 4 years (3 cases).	

properly because the patient's jaw had undergone some change in shape. Therefore, I believe that it would be wise for dental surgeons to tell their patients always to report to them any irritation that should develop.

I find that many patients who have learned to wear false teeth get the impression that since they have no teeth, nothing can go wrong about their mouth. I find too that patients who have developed irritation, and subsequently cancer, are likely to blame the dentist who made the plate. This is, as you well know, a false position to take, but the idea probably arises from the fact that the dental surgeon does not warn the patient that the jaw may change shape and that the plate may later not fit, because it remains the same.

It is difficult for anyone to make an accurate diagnosis of cancer at its very beginning. One who has had much experience in dealing with these problems can make a diagnosis reasonably early, and at the time when, in my opinion, 75 per cent of the cases should be cured. One should not expect the dental surgeon to be able to make an early diagnosis of cancer, but he certainly has the opportunity to, and can very easily, observe any abnormality about the mouth. Surely the dental surgeon looks into more normal mouths and sees more normal mucous membrane of the mouth than any other type of medical practitioner. He therefore should be able, in the matter of expertness in detecting the abnormal, to recognize some defect which should be corrected, and if this defect or lesion does not clearly belong to his field of endeavor, it is his duty to advise the patient to see someone who has had more experience in dealing with the problem.

Very frequently, it is impossible for anyone to make an accurate diagnosis as to whether a lesion is on the borderline of cancer or it has already developed into cancer. In such cases, it is my advice that the patient be seen by a physician experienced with lesions in the mouth, and that if there is a possibility of cancer being present, the patient be given preliminary irradiation, followed by biopsy and microscopic examination, if possible, within twenty-four hours. If the lesion is found to be malignant, not only should the local lesion be thoroughly treated, but also the associated lymphatic glands should receive even more attention, for it is well known that cancer anywhere about the mouth, but particularly about the tongue, spreads into the neighboring lymphatics very early. As it is generally not possible to detect the earliest involvement of the glands, one must assume that there is involvement and treat it accordingly. Certain authors prefer local surgical removal and extensive operation on the neighboring lymphatics, but, in my opinion, irradiation with radium or perhaps with high voltage x-rays will accomplish more satisfactory results, assuring more cures, and with greater satisfaction and greater comfort to the patient.

The dental surgeon can further assist in the control of cancer by removing from the patient's mind the impression that cancer is incurable. Many cancers are incurable either because they are far advanced or because they occur in locations where the disease cannot be recognized in its early stages. If cancer can be recognized in its early stage, it is usually a curable disease. As I said above, cancer of the mouth should be recognized early enough that at least 75 per cent of the cases can be cured. At present, 75 per cent of intra-oral cancers are not curable, but that percentage of cancers of the lip are. In the early stages, as our records show, 97 per cent of the cancers of the lip can be cured, but, in the more advanced stages of cancer of the lip, the

percentage is much lower, as is shown by the accompanying tables. Intra-oral cancer as it now comes to the experienced physician for treatment shows cures of only about 30 per cent. The difference between 30 per cent and 75 per cent is due to the delay or perhaps the fear of operation. Therefore, if we can eliminate from the patient's mind the fear of operation, and let him know that there are other methods of procedure equally satisfactory, he will make more of an effort to have lesions of the mouth treated in the early stage.

The accompanying tables, which were prepared by request for the International Congress on Radiology, held in Switzerland, July 23-27, 1934, present certain facts, and a few cases herewith illustrated are examples of the results to be expected.

CERTIFIED INLAY CASTING INVESTMENTS A.D.A. SPECIFICATION No. 2*

SAMPLES of all inlay casting investments certified to the Research Commission of the American Dental Association by the various manufacturers were purchased in the open market by the Research Commission and tested by the American Dental Association Research Associates at the National Bureau of Standards. As of June 24, 1935, the accompanying list of investments were found to comply with American Dental Association Specification No. 2. Investments which did not comply are omitted from this list.

FIRST SURVEY OF INVESTMENTS
(June 24, 1935)

Investment	Manufacturer or Distributor
Coecal inlay	Coe Laboratories, Inc.
Coecal universal	Coe Laboratories, Inc.
Kerr cristobalite-inlay	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Ransom and Randolph gray	The Ransom & Randolph Co.
Ransom and Randolph green	The Ransom & Randolph Co.
Ransom and Randolph X-45	The Ransom & Randolph Co.
S. S. White inlay No. 20	S. S. White Dental Mfg. Co.

*Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Dental Inlay Casting Investments; Physical Properties and a Specification, J.A.D.A., 27:2284 (Dec.) 1930.

*Released June 24, by the Executive Board of the Research Commission of the American Dental Association, C. T. Messner, Secretary, U. S. Public Health Service Building, Washington, D. C.

AN EXTRA-ORAL EXTRACTION: REPORT OF CASE

By E. C. PHILLIPS, D.M.D., Centralia, Wash.

HISTORY.—A woman, aged 27, came in complaining of nervousness, poor digestion and a breaking out on the face.

Examination.—A general examination failed to reveal anything of consequence except the impacted lower bicuspid shown in the roentgenogram. Owing to its inverted position and the fact that it was apparently directly under the mental foramen, it presented a problem. Several views were taken, from all possible angles, to ascertain its exact position and the direction it pointed. Owing to the mental foramen and the reversed position of the tooth, the largest portion being down and within a scant one-eighth inch above the lower border of the mandible, it was deemed safer to remove it from below, to avoid possible injury to the inferior dental nerve and removal of an excessive amount of bone.

Procedure.—Accordingly, with the help of Marcus Sathe, eye, ear, nose and throat specialist, of this city, who made the external incision and again closed it, the tooth was removed from the lower border of the mandible, downward, through the outside of the face or, better, the neck. The cheek tissues were pulled upward toward the side of the face so that the incision could be made well under the mandible and toward the median plane, and the consequent scar would be practically invisible on ordinary inspection. Only a small opening was necessary. The periosteum was retracted and the bone chiseled into until the point of the impacted tooth was engaged. The crown was further exposed by suitable burs. As before planned, the crown was cut diagonally through from below upward, from the cusp to the neck of the tooth. The loose half of the crown was then slipped downward through the small opening required, when, by carefully working the smallest size taper bur around the constricted area of the root at its junction with the crown, the operator removed the remaining tooth downward with root forceps. This method made it possible to affect a removal of the tooth with the least destruction of bone. The area was carefully washed out and mercurochrome applied, and the soft tissues were closed without drainage.

Condition before (left) and after (right) extraction.

Outcome.—The case healed without incident in a few days, only a small amount of seepage (almost imperceptible) occurring from the incision. The operation was performed under chloroform anesthesia, requiring less than forty-five minutes all told, though no attempt at speed was made. The accompanying illustration shows the jaw before and after the extraction.

The patient showed an improvement of the general nervous system after the operation. An article by Drs. Field and Ackerman in the December, 1934 issue prompted me to report this case.

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C. N. JOHNSON, Editor

NEWTON G. THOMAS, Associate Editor

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Editorials

THE PACIFIC COAST DENTAL CONFERENCE

The Fourth Pacific Coast Dental Conference convened at Long Beach, Calif., July 8 to 13, and there is no question of its great success.

These conferences embracing the Pacific Coast States and the Province of British Columbia are held every three years at some place on the Pacific Coast, and they have proved of great interest and benefit not only to the members of the profession in the tier of states representing the Coast, but also as a real feeder to the American Dental Association. Membership in these conferences is contingent on membership in the American Dental Association.

The great distances that must be traveled by the men of the west coast to attend the annual meetings of the A.D.A. have constituted something of a burden to the western men, but true to the tendencies and traditions of the Westerners, they have loyally sacrificed their own financial interests sufficiently to send a large representation to every annual meeting of the parent body. The fact is certain that

their quota of attendance will compare most favorably with that of any other section of the country, even with those whose members are located much more conveniently. In this connection, there is every indication that there will be a fine representation from the Coast to the New Orleans meeting in November.

The 1935 Conference proved a great success. From the adjournment of the Third Conference at Seattle in 1932 to the opening of the Fourth at Long Beach, a fine body of men devoted their best energies toward preparation for the meeting. The officers were as follows:

President, Bert Boyd, Los Angeles.
Vice-President, E. A. Tripp, Salt Lake City.
Secretary, E. Leslie Eames, Los Angeles.
Editor, Carroll W. Jones, Los Angeles.

As a recognition of loyalty to the American Dental Association, the Editor of THE JOURNAL of the Association was made Honorary President of the Conference.

The officers were supported by a loyal and efficient corps of helpers; the Executive Council consisting of twenty men from different sections of the Coast. Never did men work more faithfully or efficiently and the result was a meeting that was outstanding in every way.

The program was extensive and varied, consisting of forty-seven essays of unusual merit, and more than two hundred clinics on every possible phase of dentistry. There were twelve radio broadcasts given during the meeting of special interest to the public. Altogether four hundred men and women took part in the program.

Messages of good will were received from Frank M. Casto, President, and Harry B. Pinney, Secretary, of the American Dental Association, and a special representative from the Central Office in Chicago was sent to the meeting in the person of Lon W. Morrey, Director of the Bureau of Public Relations.

A notable feature of the meeting was the number and character of guest essayists from all sections of the country, notably from the eastern seaboard. In all, there were twelve guest essayists who graced the occasion. There were nearly one hundred exhibitors and their products were well staged and most attractive.

Long Beach proved a most fortunate meeting place. The auditorium housed the various activities most admirably, and the hotel facilities were ample and satisfactory. The weather turned out to be delightful in every way.

A meeting on the Coast always brings out some unique and varied entertainment. Golf, skeet and trap shoots and a general round of pleasure kept the visitors entertained during the week. The Women's Auxiliary Entertainment Committee had well-organized plans for taking care of the visiting ladies. Probably the most notable feature of entertainment consisted of a trip to the famed Catalina Island on Monday, where the members and visitors spent a most delightful day as guests of the Southern California State Dental Association. Another social feature consisted of the dinner dance and floor show honoring the president of the Conference, Bert Boyd, and the presidents of the conference, state and provincial associations on Thursday night.

The attendance at the meeting was approximately 1,500, which was a remarkable showing in view of existing economic conditions.

Whenever the Pacific Coast is mentioned, one of the first things that invariably enters the mind is the unbounded hospitality of the people. At this meeting, hospitality seemed to be the keynote of the hour, and those in attendance were made to feel at home the moment they reached Long Beach. From that moment to the close of the meeting, nothing was left undone to contribute to the comfort and happiness of the visitors, and the 1935 Conference will long be remembered by all of those who were fortunate enough to be present.

DENTAL CARIES AGAIN

Iconoclasm seems to be the established order of the day in many of our activities. To question anything is to invite attention at once. Men like to wonder about things, and to ask if, after all, the preconceived opinions that are commonly held are tenable. It is human nature to try to pick a flaw in the reasoning of other men, and any man's armor is subject to the darts of skepticism the mo-

ment that the armor plates are permitted to part for an instant sufficiently to admit a javelin.

This propensity of humanity is not altogether to be deplored. Without it, men would be disposed to drop into a smug complacency, and to take things too much for granted. Smugness is fatal to progress, and the mere fact of raising a question is often to stimulate thought.

We have been moved to these reflections by the never-ceasing agitation over the question of dental caries, and we are inclined to contend that we must not cease agitation till there is a better solution than any that has so far been suggested. Our editorial in the May issue on this subject has brought numerous comments, among them one from Louis Ottofy, of Oakland, Calif., in which he says:

I was deeply interested in your editorial entitled "Difficulty of Establishing the Real Cause of Dental Caries." The sooner the supposed influence of diet is abandoned, the better. I can prove by published articles that any of the vitamins will prevent caries, that none have any effect, or that by regulating the diet caries can be prevented entirely. The presumption is that by forcing calcium and phosphorus into the blood stream, those minerals will be carried into the teeth, and presto, the teeth become hard and will not decay. It is entirely overlooked that the amount of solids in the blood is about 10 per cent, and that, of this, from 1 to 2 per cent are mineral salts, among them, calcium and phosphorus. Any effort to increase that amount results in elimination, via the intestines, bladder, salivary glands and skin. The most sensible judgment on this subject is that of Dr. Arthur F. Kraetzer, author of "Your Long Suffering Stomach." He says:

"Vitamins, though absolutely essential to health, are required in infinitesimally small quantities, and more than enough of all the various vitamins will be found automatically in the average half-way decent diet of meat, fish, eggs and butter, and a moderate amount of fresh vegetables. Given enough food of the kind he likes, the average American will be pretty apt to find included in it sufficient vitamins without having to fuss about them."

Every dentist of experience has seen cases in which the teeth are sadly in need of the minerals mentioned, and yet at the same time enormous deposits of these minerals are made on the *outside* of the teeth in the form of calculus, and not in the *inside* to make enamel and dentin. It seems remarkable to me that no one has thought of the principle here involved: There are ample minerals in the blood, but they do not go where they are required. That is all. An entire, but impractical change in the mode of living would adjust that. I refer to reversion to primitive methods whereby the food (most of it uncooked) requires intense mastication, aided by the presence of foreign substances, such as sand and grit, thus increasing the flow of blood through the limited and narrow entrances of the arteries into the teeth, making them dense and thus protecting them from the external attacks that break down the dental tissues. The function of some of the endocrins is still a mystery, but I believe sufficient

experiments have been carried on with the ductless glands, without in any instance it having been found that there is any effect on caries of the teeth.

I am 75 years old, too far advanced in age to undertake the solution of this problem in the only way in which it can be solved; but there are brilliant men among our research workers who can undertake it and bring it to a successful issue. This is it. All the tissues of the body and their functions are under the control of the nervous system. There is some center located in the brain or spinal cord that influences everything that takes place in the body. These centers can be stimulated so as to increase, or influenced so as to diminish or entirely extinguish, any and every process or function of the body. Hence, there is a center in the spinal cord (probably the cervical region) which, when found and stimulated, will increase the flow of blood into the teeth. It should not be a very difficult task to discover that center, and by the gift of the roentgen rays to exactly locate it and enable its stimulation. Let our research men investigate along this line, which I have never seen suggested by any one.

Well, there you are! If you do not like Dr. Ottofy's suggestion (and frankly we cannot escape some of the skepticism already mentioned), you are at least presented with another theory to "mull over." And who knows? Someone, some day will solve this problem of dental caries, and the only observation we venture to make at this time is that, when the solution is finally reached, there will be found more than one factor involved in this process known as dental caries; in other words, as we indicated in our May editorial, it is not solely a matter of diet, and we might add, it is not solely a matter of any one thing.

SCIENTISTS HONORED

The *Daily Bulletin* of the Eighty-Sixth Annual Session of the American Medical Association, which was held in conjunction with the meeting of the Canadian Medical Association in Atlantic City, June 11-14, contains the report of the Committee on Awards "for exhibits and individual investigations, which are judged on the basis of originality and excellence of presentation." A Certificate of Merit Class I was awarded to Drs. Isaac Schour and A. G. Brodie, University of Illinois College of Dentistry, Chicago.*

The scientific exhibit holds an important place in the program of the A.M.A.'s annual meetings. Those who would take part in

*See page 1450.

it must submit their work to a committee on scientific exhibits for evaluation before a set date preceding the convention.

The first two days of the convention were devoted to the exhibit alone, that is, no other meetings were allowed to conflict with it and distract from it. That the exhibit may have its best didactic value, the man whose work it is or his first assistant must demonstrate it personally the major portion of each day. The exhibit must stay intact until the middle of the last day. The awards were announced by noon of the third day and notices of the awards placed on the exhibits. These awards are one of gold, one of silver and one of bronze and two Certificates of Merit, Class I and Class II. There were 600 booths in all.

The dental feature of the exhibit was not the primary concern of the Committee on Awards, but the intrinsic quality of the work. The men involved were only two of the 600 present. They were unknown to those who passed judgment and unknowing of what was in progress until the award was given. The incident that they represented a dental school and the dental profession is for our notice and appreciation. It means that scholarship and investigative ability in dentistry are recognized by the greatest research organization in the world. It implies as well the unbiased appraisal of such work, no matter what its origin, on its own merit, a tribute to the candor of scientific judgment. By this award, medicine may be said to urge the dental profession to encourage such investigations in its own behalf.

The exhibit itself was a composite of fundamental and clinical subjects, under the general title, "The Effect of Metabolic Disturbances on Teeth," showing the effects of hypophysectomy, of experimental hyperparathyroidism, of acute fluorosis and dental changes in a boy suffering from the hypopituitarism to be similar to the experimental results. The central panel of the exhibit presented a clinical study of the patient, the medical history and diagnosis of whose case were supplemented by cephalometric studies of his teeth, periodic intra-oral roentgenograms, plaster models and periodic oral examination. Thus was the exhibit made complete.

"The Effect of Metabolic Disturbances on Teeth" constitutes

the peak of a pyramid of study and effort which presents an instructive method in research. In a personal communication, one of the recipients of the award says, "This exhibit was the result of carefully organized team work and exemplifies the need of close cooperation between dentistry and medicine and the allied fundamental sciences." In this study with Schour, there colabored A. G. Brodie, orthodontist, of the University of Illinois, E. Q. King, physician, University of Chicago, F. A. McJunkin, pathologist, Loyola University, M. C. Smith, nutrition chemist, University of Arizona, W. R. Tweedy, biochemist, Loyola University, and H. B. van Dyke, biochemist and pharmacologist, formerly of the University of Chicago, now of Union Medical College, Peiping, China. Thus, seven scholars and four universities testify to a unity of interest and willingness to blend their efforts to a common goal.

The foregoing bit of history is full of suggestion. The place occupied by scientific and practical exhibits in the A.M.A. sessions is the result of fifteen years of development. The importance of the display as an educative means to the practitioner is natural and logical. It is visual education at its best, with the best possible teachers at hand to elucidate—the men who were the producers. The intervention of the selective committee not only deletes useless material and barren repetition, but also calls forth exertion and competitive excellence. The awards add incentive to the profession-wide endeavor. The outstanding place on the program gives the exhibits a rank, an importance equal to that of other exercises. There can be no reason that a piece of scientific handicraft should be relegated to a hidden corner,while a display of microscopic or test tube technic has a flood light on it. The two should have a parallel importance and prominence. In both fields, worth deserves recognition, approval. Dentistry has reached the time when its science is recognized, when interest in pure sciences is higher, more general than ever before. The clinical application of science in treatment and restoration keeps step encouragingly. Medicine has recognized both. Dentistry must also, more specifically, more practically than heretofore. Medical workers compete for a place and a prize: why should not a demonstrator in dentistry?

T.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Dismiss and Convince—Never dismiss a patient summarily, in a matter of fact way. He must be convinced of the real merit of what has been done. And visibility must always outrank audibility.—*Herbert Ely Williams, Red Bank, N. J.*

Will Power vs. Stubbornness—Day and night are as different as will power and stubbornness. Some persons disagree for the sake of argument alone. Patients often ignore the dentist's advice through sheer stubbornness. When a patient says "No," it is not always indicative of will power, but often of genuine stubbornness.—*Herbert Ely Williams, Red Bank, N. J.*

Unsanitary Waste Receivers—May I call attention to an unsanitary and dangerous practice of a great many dentists throughout the United States who call themselves ethical? I refer to the improper use of certain types of waste receivers at the chair, which are used for patient after patient without emptying or sterilizing or removing. Every patient should have the protection of a sterile receiver, free from the waste of preceding patients.—*C. R. Long, Smethport, Pa.*

Fees Without Figures—Dental tradition has long frowned on the mention of fees. A pianissimo effect has prevailed. Came hard going, with bills payable, and right thinking and common sense, and indelicacies of fees faded. Usually, the gold foil fee, Class 1 and 3 cavities, should be three times the amalgam or silicate fee when the dam is used. On a time basis, gold foil fees should be about 75 per cent of inlay fees. Variables and the need for three or more sittings make inlays costlier—which seems unfair—unless they are better.—*Herbert Ely Williams, Red Bank, N. J.*

A Simple Way of Bringing an Upper Central or Lateral Incisor into Line When It Has Erupted Inside the Arch—After taking an impression of the lower teeth, including about five or six teeth in the impression (that is, the teeth that occlude with the one out of line), make up a vulcanite rubber projection so constructed that, when the patient bites, the tooth out of line strikes on the rubber projection. In the case of a boy, 9 years of age, the upper right central incisor, which was inside the arch, was brought into line in less than a week.—*E. Harvey Richmond, Windsor Locks, Conn.*

Should Dentures Be Removed on Retiring?—Dentures are made for intermittent wear. It seems more logical that full upper and lower cases, having had the mandibular and maxillary relationship established, should be worn all night, but smothered, pinched and compressed gum tissues need a rest and a respite from constant pressures, which favor or cause resorption. Failure to wear dentures continually sometimes affects the sense of hearing. As a compromise, the upper set might be left out one night and the lower set the next night. Regarding partial dentures, especially with retaining clasps, there is absolutely no reason that they should be retained throughout the night. Clinical observation confirms the theory that clasps are responsible for deleterious influences especially at night when acid conditions prevail. Some patients rest much better with the denture in place. Dentures or no dentures, peaceful slumbers, rest and comfort outrank every other consideration regarding the patient's denture welfare.—*Herbert Ely Williams, Red Bank, N. J.*

Clean Handpieces—In many dental offices, handpieces and contra-angles are transferred from one mouth to another with no attempt at sterilization. Use of cutting instruments without sterilization would be unhesitatingly condemned, but many overlook the fact that a contra-angle is an ideal instrument for transferring the bacterial flora from one mouth to another. At the University of Minnesota, the following solution was furnished for use during student days: oil of bergamot, 80 minims; methyl salicylate, 160 minims; compound solution of cresol, 320 minims; light machine oil, 480 minims; benzene to make 16 fluid ounces. A pint of the solution prepared by a druggist will cost less than 2 ounces of some proprietary preparation, which will probably be almost identical. Concentration of the various ingredients may be varied at will. Needless to say, the angle and handpiece should be run in the solution, dried on a clean towel and oiled, after every operation. Mandrels, broaches, etc., may be kept in the solution in a tightly closed vessel indefinitely without rusting.—*Ralph W. Johnston, Monticello, Minn.*

Checking Centric Relation—Of the various devious methods, mechanical and otherwise, to check centric relation in making dentures, we have found that a smile does the trick. We do not use the method when obtaining the original wax bite because of the awkward feeling bite rims give to the patient, but find it very useful when teeth are set up on baseplates and there is a minimum amount of bulk and discomfort to the patient. At this time, cause the patient to smile, unconscious that he is doing so, by some remark, a picture or perhaps a story. A smile is better than a laugh. The horizontal fibers of the buccinator muscle contract and retract the corners of the mouth at the insertions of the commissure of the obicularis oris. The zygomatic muscle also plays an important part in smiling and gaining the correct mandibular position. It will also be noted that, in smiling, the muscles of the tongue retract. This organ and the tension of the geniohyoid and the mylohyoid pull the mandible backward equally on each side. Watch constantly for the maxillary relations and these are quite easily noted without the patient being conscious of it, for the lips are well parted, the teeth of the upper and lower jaws are in close apposition, and at this point centric relation is easily apprehended.—*Esther E. and F. J. Svoboda, Cozad, Nebr.*

COUNCIL ON DENTAL THERAPEUTICS

P.T.M.—A PYORRHEA NOSTRUM SOLD THROUGH THE MAIL—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

P.T.M. Formula is sold to the public through the mail, through newspaper advertising and over the radio, by P.T.M. Formula Co., Los Angeles, Calif., for the self-treatment of pyorrhea, trench mouth and related conditions. Its advertising is typical of the brazenness of the worst patent medicine exploiters.

P.T.M. is said to be "a safe sure check for pyorrhea and trench mouth; . . . a penetrating, healing germicide which relieves and checks pyorrhea, trench mouth, gingivitis and other infections of the oral cavities." It is more than that, for the advertising says:

P.T.M. FORMULA relieves pain and inflammation quickly, penetrates and attacks the germs at the seat of the infection, removing the cause. Stops bleeding gums. Reduces swollen tissues, hardens spongy gums, and retards recession.

And so on, in endless repetition and exaggeration.

P.T.M. FORMULA should be applied at the first indication of swollen, inflamed or bleeding gums.

The usual before and after pictures appear in newspaper advertising. "Heals Pyorrhea, Trench Mouth, or Money Back!" readers are told. The users "of P.T.M. FORMULA Tooth Paste and Mouth Wash now run into the thousands." For those who still remain unconvinced, testimonials are furnished. The reader is invited to send $5 through the mail for an introductory special offer for P.T.M. Formula (Concentrate), P.T.M. Formula Medicated Tooth Paste, and P.T.M. Formula Antiseptic Mouth Wash.

In a memorandum sent to the Council by the Better Business Bureau of Philadelphia, the Council is told that "Jackson Diggs, the proprietor of the company, has been spending quite a lot of time in experimental work in connection with their product P.T.M."

The Council learns that Mr. Diggs bought a secret formula from one John B. Craven, of Long Beach, Calif., who is unknown to dental science. The formula has been tested as claimed by the P.T.M. Company, but apparently the results were not such that they cared to make them public. The Council is informed that the product was left at the Dental College of the University of Southern California, which wrote as follows to the Better Business Bureau of Los Angeles:

Your letter of June 15th regarding information concerning the P.T.M. Company, Mr. Jackson Diggs, received. I hope you will pardon the few days' delay in my obtaining the information regarding this matter. I find upon investigation that they left some samples of their product here with our Pathology Department and the same was tried on a few cases for about two weeks. They called again on the head of the Pathology Department and were informed by him that the product did not answer the claims made or the specifications for the same. We therefore discontinued any further experimentation with the product. We prefer to have nothing more to do with the concern as they are broadcasting the uninformed statement that we are recommending their product. I wish it thoroughly understood that we are not recommending, endorsing, or approving their product. There are many of these types of people that leave samples and are very insistent on having us see what they are, but as stated before, this product was

tried out for a couple of weeks, then they were notified that it did not come up to their claims.

It is a favorite trick of some of the patent medicine gentry to leave samples of their products at dental schools, dental associations and the like, and, without further ado, inform prospective purchasers that samples had been left at such institutions for tests. The prospective purchaser is, of course, not expected to ask for the authenticity of the tests or the data.

Despite the circumstance that the advertising for P.T.M. Formula in 1931 left little to be desired in the way of claimed results, it appears that the product is still undergoing change. In response to an inquiry from the Council, Mr. A. G. Hall, professor of materia medica at the University of Southern California, who had recently become associated with the P.T.M. Company, informed the Council that some improvements were being made in their basic formula, which is said to be approximately:

5% Zinc Salts, including zinc pheno sulphonate
½ of 1% of iodine
$\frac{1}{10}$ of 1% phenol, thymol, acid, salts, solvents, and correctives, in quantities sufficient to stabilize and correct any tendency toward toxicity.

Such a statement of composition obfuscates rather than clarifies.

Although Mr. Hall, writing for the company on the stationery of the University of Southern California, promised in October, 1934, to send the scientific data on completion, they have not yet been received, although the product has been sold through the mail since the early part of 1933. The qualitative statement of composition of Mr. Hall indicates that the "basic formula" is a shotgun mixture. There is no evidence available that this shotgun mixture will act as "a safe, sure check for pyorrhea or trench mouth." Both claims are pernicious to a degree, since they may lead the uninformed suffering from pyorrhea to place false confidence in it, and, in the case of trench mouth, they may lead to a spread of this virulent disease.

Mr. Hall frankly confesses that the company is not yet in a "position to ask for acceptance of the product in the list of accepted dental remedies."

Meanwhile, tests of the product have been carried out in the A.D.A. Bureau of Chemistry. Chlorides, sulphates, zinc and potassium compounds were found. Iodides, free iodine and chlorates were not found.

P.T.M. Formula represents an unmitigated abuse of the confidence of sufferers from gum disease, who cannot expect to be cured by the use of this nostrum. The treatment of pyorrhea, trench mouth and other gum diseases belongs to the dental clinic and not to the patent medicine exploiters.

After the foregoing report was prepared, and while in the process of being considered by the Council, Notice of Judgment No. 23281 (issued May, 1935) for misbranding of P.T.M. Formula Home Treatment came to the attention of the Council. It was charged in the libel that unwarranted curative and therapeutic claims were made. Misbranding was charged in violation of the Food and Drugs Act as amended. Analysis showed that the medicated mouth wash consisted essentially of zinc sulphate, sodium chloride, glycerine, alcohol (4.5 per cent) and water (approximately 93.5 per cent) flavored with peppermint oil; the concentrate consisted essentially of zinc sulphate, sodium chloride, glycerine and water, colored and flavored; and the medicated tooth paste consisted essentially of calcium carbonate, soap, glycerine and water, flavored with peppermint oil.

Misbranding was alleged because the following statements, among others, appearing on the label and regarding the curative and therapeutic effects of the article were false and fraudulent:

Extremely beneficial in the treatment of Sore and Tender Gums; . . . Use P.T.M. Formula Medicated Tooth Paste morning and evening for all mouth and gum infections, tender, sore or

bleeding gums; . . . When you have completed the treatment, you may discontinue using the concentrate, but by all means continue the use of P.T.M. Formula Medicated Tooth Paste and P.T.M. Formula Medicated Mouth Wash twice daily to prevent re-infection and keep your mouth and gums in a healthful condition. . . . P.T.M. Formula products give you daily protection against infection. There is no better insurance for your Teeth.

The claimant for the product admitted the allegations of the libel and consented to the entry of a decree; judgment of condemnation was entered, and the product was released on bond, on the condition that it be relabeled under the supervision of the Department of Agriculture.

The Council approves the action of the Food and Drug Administration in seizing the product. It is unfortunate for those who are led to purchase the material, in the hope of alleviation or cure by suave appeal, that only this meager protection is afforded by a food and drugs act, which needs serious revision in the light of present-day conditions. Products of this type, contrary to scientific dental knowledge, should not be permitted to be sold, not only in interstate commerce, but also in intrastate commerce, if the health and interests of the citizens are not to be subjected to serious abuse.

It is interesting to note that the name of the company has changed. Now it is P.T.M. Products, Inc., and the product continues to be sold through the mail, but essentially the same false and misleading claims can continue to be made for the product provided the exploiters are careful enough not to place the claims on the label. Unfortunately, the present Food and Drugs Act gives the Department of Agriculture no jurisdiction over false and misleading or fraudulent advertising.

KLEX—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

In view of the report of the A.D.A. Bureau of Chemistry which follows, the Council declares Klex not acceptable for A.D.R.; i.e., because a statement of composition does not appear on the label (Rule 1); it is advertised with unwarranted and misleading claims (Rule 6); it is a well-known product sold under a name uninforming as to composition (Rule 8), and the use of the product under the guise of secrecy is not in the interest of the dental profession and the public (Rule 10).

The Council has repeatedly pointed out the damage that is done by the application of hydrochloric acid to teeth. Its sale to the dental profession for removing stains under the guise of secrecy is an imposition on the profession.

The report of the A.D.A. Bureau of Chemistry follows:

Two (2) original bottles of Klex (Harry B. Price Dental Depot, Chicago, Ill.), price $1 each, were purchased for examination.

The label stated:

Klex will remove nicotine, black and green vegetable stains from teeth instantly. Klex will not injure gum tissue or tooth enamel.

The bottle examined contained 170 c.c. of a red odorless, acrid-tasting liquid. Its reaction was acid to litmus, and it turned yellow when treated with alkalis. The specific gravity at 23 C. was 1.07. Qualitative examination indicated the presence of hydrochloric acid.

Quantitative examination yielded the following: hydrochloric acid, 2.03 gm. per hundred cubic centimeters.

From the foregoing, it may be concluded that Klex is a 2 per cent solution of hydrochloric acid, colored with a red dye, possibly methyl red.

MORE MISBRANDED DENTAL NOSTRUMS

Beginning with this issue of THE JOURNAL, the abstracts of the Notices of Judgment of actions taken under the Food and Drugs Act of 1906, as amended, are presented in tabular form. Further information concerning them may be obtained by addressing the Council.

SAMUEL M. GORDON, *Secretary.*

N. J. No.	Date Issued	Name	Manufacturer	Composition	Claims	Findings
22351	Dec., 1934	Dunlop Pyorrhea Paste Dunlop's Ethyl Borate (See also J.A.D.A., 22:146 [Jan.] 1935; 22:674, 678 [April] 1935)	Emme Dental Specialty Co., St. Paul, Minn.	Paste: boric acid, glycerine, alcohol and oil of peppermint Ethyl borate: boric acid, peppermint oil and alcohol	Effective in treatment of pyorrhea and mouth diseases; effective remedy and cure for trench mouth or Vincent's infection Effective in treatment of trench mouth and pyorrhea, and all other mouth and gum diseases	Article misbranded and adulterated; claims false and fraudulent; article contained less than stated amount of alcohol Article misbranded and adulterated; claims false and fraudulent; article contained less than stated amount of alcohol
22356	Dec., 1934	Dunlop Pyorrhea Paste	Dunlop Pyorrhea Machine Mfg. Co., St. Paul, Minn.	Boric acid, glycerine and alcohol, peppermint oil	Effective in treatment of pyorrhea and oral disease; effective in treatment of trench mouth; insures health of teeth	Article misbranded and adulterated; claims false and fraudulent; article contained less than stated amount of alcohol
22352	Dec., 1934	Or-Aid (See also J.A.D.A., 22:674 [April] 1935)	Or-San Co., Minneapolis, Minn.	Zinc chloride, zinc sulphate, boric acid, sodium compounds, water and oil of peppermint	"Destroys Germs . . . It is a Germicide . . . since bacteria can be killed by the use of Or-Aid . . . Contains . . . Emetine Hydrochloride . . ."	Article misbranded, as it was not a germicide, and emetine hydrochloride was not contained in formula; claims were false and fraudulent
22364	Dec., 1934	X-It (See also J.A.D.A., 16:365 [Feb.] 1929)	Manufacturers Direct Sales Co., Brooklyn, N. Y.	Alcohol, zinc chloride, methyl salicylate and extracts of plant materials	Effective in the treatment and prevention of pyorrhea, recession of gums, looseness of teeth, bleeding of gums, trench mouth, pus pockets, etc.	Article misbranded; statements false and fraudulent

22577	Feb., 1935	No. 1 Pyroligneous Compound, No. 2 Pyroligneous Compound and Healing Ointment (See also J.A.D.A., 22:678 [April] 1935)	Tilton Laboratories, Clinton, Iowa	No. 1: ammonium carbonate, ammonium hydroxide and pyridine, 98 per cent water. No. 2: ammonium hydroxide, pyridine, phenolic substance, 98 per cent water Healing ointment: volatile oils as camphor, peppermint oil and turpentine oil, in an ointment base	No. 1: Effective for soreness of mouth, pyorrhea, etc. No. 2: Effective for swollen glands, goiter. Healing ointment for throat, abscesses, in infections, etc.	No. 1, adulterated; article not a germicide, disinfectant. No. 1, No. 2, and Healing Ointment misbranded; claims false and fraudulent
22374	Dec., 1934	Acco Aspirin Tablets	Feldman-Martin Co., New York, N. Y.		Recommended for toothache, etc.	Article misbranded; claims false and fraudulent
22627	Feb., 1935	Acco Aspirin Tablets	Albany Chemical Co., Albany, N. Y.	5 grains of acetylsalicylic acid each	Recommended for toothache, etc.	Article misbranded; claims false and fraudulent
22601	Feb., 1935	Kelfood	Protective Diet League, Hollywood, Calif.	Sea weed, fatty oil and yeast	Effective for tooth decay, softness of bones, rickets, etc.	Article misbranded; claims false and fraudulent
22604	Feb., 1935	Oxiton Mouth Wash	Royal Sundries Corp., New York, N. Y.	Manganese, sulphate, and water, oil of cinnamon and amaranth	Recommended for trench mouth, pyorrhea, bleeding and sponginess of gums; said to leave the mouth in a healthy . . . condition . . .	Article misbranded; claims false and fraudulent
22620	Feb., 1935	Dunlop Pyorrhea Paste (See Notice of Judgment 22356, issued Dec., 1934, above)	Dunlop Pyorrhea Machine Mfg. Co., St. Paul, Minn.			
22657	Feb., 1935	Aspirin Tablets	Hampton Mfg. Co., Inc., Carlstadt, N. J.	Less than 5 grains aspirin per tablet	"Tablets . . . Aspirin 5 grains"	Article adulterated and misbranded, since tablets contained less than 5 grains aspirin as stated on label

(Continued on next page)

MORE MISBRANDED DENTAL NOSTRUMS (Continued)

N. J. No.	Date Issued	Name	Manufacturer	Composition	Claims	Findings
22963	April, 1935	Kal	Makers of Kal, Los Angeles, Calif.	Powdered rice, cocoa and dicalcium phosphate	"Calcium is necessary for every tissue in the body, particularly . . . bone, teeth . . ." Kal is recommended to restore calcium balance	Article misbranded; claims false and fraudulent
22968	April, 1935	Sulfox	Sulfox Mfg. Co., Mansfield, Ohio	Sulphur dioxide, sulphuric acid, ash and water (99 per cent)	Effective in diseases caused by the teeth, pyorrhea, halitosis, etc.; said to be germ destroyer	Article adulterated, not a germ destroyer; misbranded; claims false and fraudulent
22969	April, 1935	Fagisote	McKesson Langley Michaels Co. Ltd., San Francisco, Calif.	Lime water solution of wood creosote plus glycerine	Effective in pyorrhea, sponginess and bleeding of gums, etc.	Article misbranded; claims false and fraudulent
22970	April, 1935	Magnesia Oxoids	Eton Products, Inc., New York, N. Y.	Magnesium oxide, magnesium peroxide and starch	Effective for bad breath, tooth and gum troubles, etc.	Article misbranded; claims false and fraudulent
22979	April, 1935	Kojene Antiseptic (See also J.A.D.A., 22:145 [Jan.] 1935)	Kojene Products Corporation, Rochester, N. Y.	Oxyquinoline sulphate, benzoic acid, sulphur dioxide, methyl salicylate and water	Recommended as an antiseptic mouth wash and gargle. "Soft, Spongy, Bleeding Gums may lead to Pyorrhea. Go over them every night and morning with a bit of cotton soaked in Kojene . . ." Recommended for postoperative irrigation, pyorrhea, etc.	Article misbranded; not an antiseptic agent when used as directed; claims were false and fraudulent
22992	April, 1935	Chalon Antiseptic Mouth Wash	Leading Perfumers, Inc., New York, N. Y.		Stated to be "Antiseptic"	Article adulterated and misbranded; not antiseptic; statement false and fraudulent
22993	April, 1935	Ora-Noid Mouth Powder (See also J.A.D.A., 16:554 [Mar.] 1929; 22:687 [Apr.] 1935)	Ora-Noid Co., Chicago, Illinois	Table salt, precipitated chalk, baking soda, magnesium and potassium compounds, flavored with cassia oil	Effective in keeping teeth, gums, etc., healthy. Strengthens the gums, draws fluids out of inflamed tissues, etc.	Article misbranded; claims false and fraudulent

BUREAU OF PUBLIC RELATIONS

DO YOU BELIEVE DENTISTRY DESERVES RECOGNITION IN THE LIFE INSURANCE EXAMINATION?

By MILLARD D. GIBBS, D.D.S., Hot Springs, Ark.

THE question, Do you believe dentistry deserves recognition in the life insurance examination? is addressed to all members of the dental profession. If, from your experience and observation, you are convinced that dental infection plays an important part in many systemic diseases as a causative or contributing factor, it is to be assumed that you will answer in the affirmative.

May I ask if you have discussed this question with your insurance friends? Have you written a letter to the president or medical director of the company in which you have insurance, suggesting that they include a dental examination in the physical survey that they require of applicants and policy holders?

There are approximately 65,000,000 policy holders, and thousands of annual applicants; which emphasizes the enormous contact that these companies have with the public. With such a contact, their opportunity to spread propaganda regarding all health questions is unlimited. Such facts and figures should cause the dental profession, as a health unit, to better acquaint life insurance companies with the merits dental recognition would bring, developing for them better risks and naturally resulting in a lowering of mortality table figures, to say nothing of better health protection for those whom they serve, including lowered premium rates. There can be no doubt that such a relationship between dentistry and life and health insurance companies would prove a mutual benefit, this benefit extending to applicants and policy holders. Therefore, in asking such recognition, we certainly cannot be accused of altogether selfish motives.

In 1932, there was begun an effort to arouse interest in recognition of the importance of dental health by life insurance companies, and it is with profound gratitude that acknowledgment of the excellent support given the idea is made. Support has come from the dental, medical and insurance groups and from publications representing those bodies. Editors have it in their power to awaken wide interest in such undertakings and to aid materially in the consummation of such a purpose. The cause that we are fighting for needs the continued support not only of those who have aided, but also of all who will. Through many letters of comment, new ideas have been suggested, which have enabled me to discuss many phases of insurance which it would have been otherwise impossible to cover. Personal contacts and discussions with insurance men have proved most helpful and are appreciated.

That you may know more definitely the reaction that has occurred in this endeavor, let me quote from the letter of a

president of one of the leading companies, and also from one received from the chief medical examiner of one of the oldest and strongest life insurance companies. The president said:

I have read with much interest your address on "Life Insurance and the Medical Examination" and I am thoroughly in accord with your views that the dental profession has an important part in the conservation of health. There is no doubt that a careful examination of the gums and teeth of applicants for life insurance would reveal germs which, in the course of years, would break down the applicant's health.

From the medical director came this comment:

Our attitude I think is quite similar to that expressed in our previous communication, that is, although we realize and appreciate the importance of dental conditions to the general health, it does not seem that it would be profitable to require such examination at this time. I am speaking very largely from the standpoint of the practical side of the selling of insurance, and I am taking no issue with you concerning the professional logic of your statements.

I quote also from the medical director of a foreign company:

I am very glad to note that you appreciate the economic and practical difficulties of including examination by qualified dentists as a part of a life insurance examination. All of us will be very glad to include it whenever circumstances may allow.

The following is from a general agent of a widely known and popular company:

I don't think there is any question that life insurance mortality percentage could be decreased through a thorough dental examination in addition to the regular medical at the time the insurance is applied for. That, however, is a problem for you men in the dental profession, and, no doubt, provided you keep hammering away, such an examination will be required at some time in the future.

The following letter is from the state manager of an outstanding company:

I am genuinely sold on the merit of your idea that a dental examination in connection with medical examinations for life insurance would be most favorable from the standpoint of the company and of the applicant as well. This would give companies an opportunity to select risks with greater discrimination and, at the same time, discover for applicants impairments that could be corrected or adjusted without serious consequences.

These extracts, from letters of men prominent in the insurance world, have been presented that you might get their reaction and more fully realize that the time is ripe for dentistry to make a concerted effort for a full and complete recognition by life insurance companies. The replies, as you can see, have been most courteous and frankly expressed. Virtually all agree that the advantages set forth regarding the value of dental investigation of applicants and policy holders are all that is claimed, the chief objection centering, in their opinion, around the selling end of insurance and the competition that they must meet. At another time, I am hoping to discuss that phase of the question, and I shall try to present evidence that dental examinations would aid rather than hinder in that department of life and health insurance.

Since the medical profession has the recognition that we are seeking, let us keep before our medical friends the thought that no general physical examination should ever be considered complete which does not include a careful dental investigation by a qualified dentist. This is worth while as propaganda, based upon and backed by scientific facts, and should result in a decided improvement in medicodental relations, not only in safeguarding health, but also in treating properly many physical disorders, and in establishing closer ties between the two professions. With the advancement that

has been made in medical and dental science, as it relates to health and disease, there is every reason for a more definite cooperation.

Unfortunately for public health and the dental profession, dental ailments are not, as a rule, investigated by the majority of physicians and surgeons in making general physical examinations. In surgical work, it has been found that dental infection retards the healing of surgical wounds and is responsible for a good percentage of other serious complications.

These statements concerning the medical profession, which are based upon discussions with and expressions from progressive men of that calling, are brought to your attention with the hope that something of a constructive nature may result in the matter of seeking from every angle for the causes and contributing causes of physical disorders which have been overlooked by many practitioners. In our own profession, the same unfortunate situation exists, for there are men who, engrossed entirely in the esthetic and mechanical department of dentistry, seem to be blind, in large measure, regarding the relationship of dental infection to systemic disease or systemic disturbances that manifest a decided reaction on the teeth and peridental membranes.

Health is most important to the individuals, to industry, to the nation. Disease, during the World War, killed more than fell in battle. Thus, it is not difficult to decide that health must be protected. When the health of nations is at its peak, there are no organizations that profit more than do life and health insurance companies.

In the conduct of any business, even when sound methods are not in evidence in all of its departments, a varying degree of success is possible. Success can, in some instances, cause those who head such organizations to be satisfied and not interested in ways and means for increased success. Old methods now in vogue in the conduct of life insurance companies as to rules governing the acceptance or rejection of applicants have, in a measure, proved successful in a financial way. Many accepted applicants, regardless of dormant or active dental infection, are placed according to age classifications with policy holders who are first class physical risks, and in every age class there exist first class risks. Why should the A-1 risk have his rating jeopardized by placing lower rated risks in his classification? It is being done every day, and the A-1 policy holder is paying, because of this forced liability, a higher premium than he should pay. Dental investigations and corrections would make a good percentage of poor risks A 1.

Painting a word picture in beautiful phrases and giving it a colorful setting may result in failure to bring defects of the subject to the surface, but, in the health case, we need to magnify the defects lest they prove costly to those who have entrusted their health problems to us.

Again, may I suggest that you write the president and medical director of your insurance company, recommending that they include a dental investigation in the physical examination that they require, and thus play an important part in the final realization of recognition for the dental profession by life insurance companies. With an army of 60,000 dentists, whose profession has become recognized as a health unit of vital and profound proportions, surely we are deserving of recognition as an aid in promoting better health conditions in any organization whose foundation is builded upon the health and longevity of those whom they insure.

THE TEETH AND HEALTH*

PREVENTION is the watchword of today. Prevention is the portal through which mankind must pass in order to enter the hacienda of health. I can remember as a child hearing my grandmother say that if our foresight was one-half as good as our hindsight, we would save ourselves much misery. Needless to say, if our foresight in respect to both sickness and health was one-half as good as our hindsight, a large percentage of our sick beds could be relegated to the museum of antiquities; a preponderance of prescription pads and their pernicious partner the patented pill would soon become as antediluvian as transportation by ox team or model T's. Hospitals could be transformed from havens of helplessness to halls of health. Health workers, of which there are about 1,300,000 in this country, including physicians, dentists, nurses, pharmacists and members of associated professions, could devote their full time to the promotion of health and prevention of pain instead of battling bacteria and waging war on wanton disease and death.

Modern medicine and modern dentistry are striving toward the goal of prevention: Prevent disease, prevent illness, prevent accidents, prevent all those destructive conditions which impair health and happiness. The word "prevention" should be made as much a part of our health vocabulary as it is a part of our prayer book. "Keep us from sin, O Lord" we plead in daily prayer. Keeping ourselves from becoming ill should be common practice in daily life. If appraisals are made of a child before he shows signs of illness, the application of existing scientific knowledge may often prevent the development of disease and defects which might seriously hamper him throughout the remaining years of his life. This, of course, calls for a better understanding and a more thorough knowledge on the part of all of us regarding our human machines. In fact, knowledge of the human machine is more important to the welfare of the child and the adult of today than ever before. Changes in social and economic relations, changes in housing and transportation, changes in nutritional problems come so suddenly that the only chance for adjustment lies in intelligent action based on knowledge. One of the important recommendations made a few years ago at the White House Conference on Child Health and Protection was that a working knowledge of the human machine and what keeps it running smoothly should be counted as important for school children as the three R's.

Once we realize that a normal child is one that is sound in body and in mind, harmoniously developed physically, mentally and emotionally, we will have hurdled the first barrier to prevention of disease. Contrary to traditional belief, general superiority of intellect is today thought to be found in persons who are also superior in other respects as in physical health and social adaptation. In other words, the intellectually superior child who is sickly, a poor mixer or otherwise inferior is now considered not the rule, but the exception.

The normal, healthy, happy child, the type most likely to develop into the best citizen, the backbone of the nation as it were, must be mentally and physically free from disease. Every sick spell, every accident to the human flesh, leaves a scar of some kind which the individual car-

*Radio talk.

ries for the remainder of his life. Sometimes, those scars are very, very minor and do not affect the efficiency. Quite often, they are of such magnitude that the recipient suffers consciously or unconsciously from them for life. Many of you listening in today know someone in your family or your circle of friends who is suffering from serious disability such as heart trouble or kidney trouble which he would have escaped had he applied proper preventive measures.

One of the simplest and most effective preventive measures within the reach of us all is mouth sanitation. There is no doubt that infected, neglected teeth cause a great deal of unnecessary illness. Not long ago, Dr. Rosenow, of the Mayo clinic, an authority in medical and dental research, stated that a sane and comprehensive effort toward preventing and eliminating infected areas in the body "will often result in the prevention and cure of chronic diseases; in the alleviation of human suffering; in a better preservation of the tissues of old age; in a longer average duration of life, and in increased mental and physical efficiency, and will, through the laws of heredity, make for a sturdier race." Since dental foci of infection are so common, it is quite obvious that, in their prevention, we automatically, in many cases, prevent the more serious systemic diseases. Remember, then, in your efforts to bestow gifts on your children, that good health is the greatest gift of all. No person, no family, no country can progress for long without it. It is estimated that there are about 45,000,000 children in the United States, and authorities say about 22 per cent, or 10,000,000, of them are suffering from some form of ill health. Poor nutrition, defective speech and weak hearts are found in 80 per cent of these sick children.

Of the 35,000,000 children who are supposed to be reasonably well, about 90 to 95 per cent have dental defects. The Committee on the Costs of Medical Care has found that "people suffer much unnecessary pain and many obscure disorders because of bad teeth." Yet, let us repeat, about 90 per cent of children of school age average as many as four decayed teeth each. One of America's greatest medical authorities makes the statement that a large percentage of the diseases which affect the human system can be traced to the mouth. The same authority also says that the difference between a well cared for mouth and an unhealthy one is ten years of life.

Let us stop for a moment, repeat and analyze those three statements: (1) people suffer much and unnecessarily because of bad teeth; (2) a large percentage of human diseases can be traced to the mouth, and (3) between 90 and 95 per cent of school children have badly decayed teeth. Those statements or facts mean something. Briefly, they mean this: We, as parents, are directly responsible for much of the disease visited upon our children simply because we do not recognize the fact that the condition of the child's teeth directly affects the child's general health. Since it is true that a large percentage of our human diseases can be traced to bad dental conditions, the logical thing for us to do, since we are interested in our children's welfare, is to prevent their teeth from decaying. By so doing, we will automatically prevent much of the disease that human flesh is heir to. Unfortunately, we do not know at the present time the actual cause of decay; and until we do do know the actual cause we probably will have great difficulty in entirely overcoming it. We do know, quite definitely, how to prevent serious dental decay for a large majority of our children. By employing four simple rules in the daily life of each

child, we can provide them with better teeth.

First, we must provide the child with proper nourishment. Teeth are composed largely of calcium or lime and phosphorus. These two minerals are obtained from foods. Therefore, we must provide the child, both before birth and for at least the first sixteen years of life, a sufficient amount of those foods which are high in calcium and phosphorus in order that the bones and teeth may be well nourished. Generally speaking, that means plenty of milk, vegetables, fruits, whole grain cereals and breads, meat and eggs.

The second preventive measure which every parent should employ to assist the child to have good teeth is exercise—exercise of the jaw bones and supporting tissues about the teeth. Eating a certain amount of coarse foods each day or each meal stimulates the jaw muscles and gums and helps keep them healthy.

The third preventive measure is cleanliness. While, in a general sense, it is not true that a clean tooth never decays, it is true that clean teeth are less likely to decay than are unclean teeth. From a hygienic and esthetic standpoint, teeth should be thoroughly brushed at least twice a day. The fourth preventive measure is early and regular dental attention. To paraphrase an old and popular maxim —"A stitch in time saves nine"—we can say "A trip in time saves nine." One or two early trips to the dentist before decay has progressed very far not only will save your child several long and painful trips later, but they may also save him from contracting some serious physical disability resulting from infected teeth.

Ex-President Hoover once said: "Human progress marches only when the children excel their parents." One way to provide your children with better health than your own is to provide them with better teeth and to prevent those teeth from decaying and infecting their bodies.

AN ACHIEVEMENT IN DENTAL HEALTH

EACH year since 1929, Mr. Herman Voigt, principal of the St. Paul's Evangelical Lutheran School, Melrose Park, Ill., has graduated his eighth grade of between fifty and sixty boys and girls with "100 per cent" teeth.

In the past seven years, a total of approximately 400 children have left the shelter of his institution with a deep appreciation and clear understanding of dental health.

Mr. Voigt, a slim, straight, gray-haired figure in his middle fifties, with the spring and enthusiasm of youth, has the modern educator's point of view. He skilfully blends the teaching of elementary education, health and Christianity into his program, and still has time to lead the choir, teach singing and take a leading part in church affairs.

He shares credit for this achievement in dental health with Miss Yohnke, Chicago Tuberculosis Institute nurse, who for years had charge of the health activities in the St. Paul School. Actually, it was Miss Yohnke who conceived the idea, seven years ago. She has been the driving force behind the project. She inspired the teachers. She and Mr. Voigt secured the cooperation of the parents. Together, they obtained the help of the local dentists. Between them, during the

past seven years, they have graduated 400 children free from dental infection into the neighboring high schools.

Each year, at the graduation exercises, each child is presented with a certificate of dental health. Each year, the graduating class is presented with a gold and embossed dental health certificate, issued by the Illinois Department of Health and the Illinois State Dental Society.

Placing the mouths of from fifty to sixty children in excellent shape each year is no small task. There are dissenters, there are procrastinators and there are some who simply can't afford the smallest filling nor the simplest extraction. Moral suasion on the part of Mr. Voigt and Miss Yohnke takes care of the former. The charitable and kindly dentists take care of the latter.

Each year the task becomes easier, but, as Mr. Voigt says, "without the cooperation of everyone, children, teachers, parents and dentists, St. Paul's would still be archaically graduating the children dentally unfit to enter high school."

Graduates from eighth grade, St. Paul's Evangelical Lutheran School, Melrose Park, Ill. Every member of the class has "100 per cent" teeth.

Special Course in Public Health Dentistry for Children

Teachers from the Harvard Dental School cooperated with the Forsyth Dental Infirmary in the conduct of a special course in public health dentistry for children which was given for a group of dentists from Michigan, as announced by Percy R. Howe, director of the Forsyth Infirmary and professor at the Harvard Dental School.

Under a grant from the W. K. Kellogg Foundation of Battle Creek, Mich., groups

of dentists from various parts of the State of Michigan were sent for a two weeks' course, consisting of lectures, demonstrations and observational work in the clinics of the Forsyth Infirmary. The selection of the men and all other arrangements were under the charge of Emory W. Morris, associate executive director of the Kellogg Foundation.

Among the members of the Harvard Dental School staff who participated in the conduct of the course were Dean Leroy M. S. Miner, professor of clinical oral surgery; Fred R. Blumenthal, assistant professor of orthodontia; Harold E. Tingley, assistant professor of operative dentistry; and Frank Delabarre, associate in orthodontia in the school's postgraduate course. Others who assisted were Charles F. Wilinsky, of the Beth Israel Hospital; Max H. Jacobs, and, from the staff of the Forsyth Infirmary, Percy R. Howe, director; Miss Ruth L. White, chief of the nutrition department, and Mrs. Booth, of the statistical department.

According to the arrangements, a large number of dentists were sent from Michigan in groups of from fifteen to twenty each. These men were selected by the officials of the Kellogg Foundation with the cooperation of the Michigan State Board of Health. The first group commenced its studies June 3 at the Forsyth Infirmary, and during the next month or two, the remaining groups followed. The men established residence in Boston, and in addition to their instruction at the Forsyth Infirmary, there were opportunities for them to visit various hospitals and clinics throughout greater Boston.

Summary of Old Age Pension Situation*

State	Amount Per Month	Residency Years	Average Being Paid	Number
Arizona	$30.00	35	$ 9.01	1,624
California	30.00	15	21.16	14,064
Colorado	30.00	15	8.59	8,705
Delaware	25.00	5	9.75	1,586
Idaho	25.00	10	8.85	1,090
Indiana	15.00	15	First year in operation	
Iowa	25.00	10	Start—July 1, 1935	
Kentucky	20.83	10	No funds	
Maryland	30.00	10	29.90	141
Michigan	30.00	10	No funds	
Minnesota	30.00	15	13.20	2,055
Montana	25.00	15	7.28	1,781
Nebraska	20.00	15	No funds	
Nevada	30.00	15	15.00	23
New Jersey	30.00	15	12.27	9,015
New York	No maximum	10	22.16	51,016
North Dakota	12.50	20	No funds	
Ohio	25.00	15	First year in operation	
Oregon	30.00	15	No funds	
Pennsylvania	30.00	15	No funds	
Utah	25.00	15	8.56	1,096
Washington	30.00	15	Legal difficulties	
West Virginia	30.00	10	Not yet accepted Compulsory in 1935	
Wisconsin	30.00	15	16.75	1,940
Wyoming	30.00	15	10.79	634

*From the Boston Post, 1935.

A SAD STORY OF MARY SUCK-HER-THUMB

PERHAPS you remember that one of the children from the Land of Somewhere had a very queer name. Everybody called her Mary Suck-her-Thumb. That wasn't her real name. At home her mother called her just plain Mary Jackson, but her playmates called her Mary Suck-her-Thumb, and in Health Land the Healthy-O's were so astonished to see a child with her thumb in her mouth nearly all the time that they too began to call her Mary Suck-her-Thumb. After a time they forgot her real name.

At home the children had not thought so much about Mary's sucking her thumb, but when they all got to Health Land, where everybody was healthy or trying to be, they began to be ashamed of her.

When Mary walked down the streets of Health Land her thumb was in her mouth. If a pleasant little Healthy-O said "Good morning," Mary had to wait to take her thumb out of her mouth before she could answer. Even at play she would suck her thumb every time she got a chance, no matter how dirty her hands were.

One day the children thought of a plan which they believed would make Mary very much ashamed. They wrote a little card and hung it in her room at the foot of her bed. This is what it said:

Mary had a little thumb,
She sucked it all the day,
She couldn't laugh, she couldn't sing,
Her thumb was in the way.

Mary didn't like to read what was written on the little card, and she threw it into the fireplace. That night when she went to bed she said, "I will not suck my thumb tonight."

She put her thumb way down under the covers and went to sleep, but the next morning when she awoke, there was her thumb in her mouth.

Even the King of Health Land called upon her one day and said: "Mary, do you know it is one of the rules of our country never to put anything into your mouth but food and drink and your toothbrush. You will never be a pretty child unless you stop sucking your thumb."

But Mary still loved her thumb so much that she couldn't or wouldn't stop sucking it.

One day the Healthy-O's gave the children a party out under the trees. They played all sorts of games and had great fun, but there was one thing the children liked particularly well. That was the fortune-telling tent. It cost five cents for a ticket. Arthur Fortune, a handsome Healthy-O in a blue suit with brass buttons, sold the tickets at a little stand. When a child entered this big tent he found many, many mirrors, one after the other. By looking into these mirrors he could find his future told with pictures.

Mary stood in front of the big white tent for a long time, busily sucking her thumb. The boys and girls went in one after the other, and they usually came out smiling. Some came out looking very angry, and some even shed tears.

At last Mary thought she would go in, too. She paid her five cents and, still sucking her thumb, walked into the big tent. She stepped in front of the first mirror and looked. There she saw herself sucking her thumb and looking very foolish. Underneath were the words, "Mary Suck-her-Thumb just as she is now, nine years old."

"What will be in the next?" sighed Mary.

In that she saw a picture of several of the nicest girls from Somewhere. They wore their best dresses and walked by, one by one, smiling. How beautiful they looked! Mary was so interested in looking at them that she forgot about herself until she appeared in the mirror grinning and bowing, but still sucking her thumb. At the bottom of the glass were the words, "Mary sees herself as others see her."

"Oh, dear," said Mary, "I thought this was to tell us about our fortune."

That story began with the next mirror.

There was a picture of Mary sick in bed with a very bad cold, but still sucking her thumb. Down below she read: "Sickness often comes from dirt. Mary gets her hands very dirty and then puts her thumb into her mouth. Poor Mary, will she never learn?"

Mary felt almost afraid to look farther. When she did stop in front of the next mirror these words were flashed before her, "What a sad sight Mary was when she was thirteen years old."

As she looked into the glass she saw a girl who looked something like herself. She too was sucking her thumb. When she took it from her mouth Mary saw that she looked very tired and ugly. Her lips and teeth were all drawn forward and her face was out of shape.

"Ugh, how ugly!" said poor Mary, bursting into tears. "I will not see any more," and she ran toward the door of the big tent.

"What's the matter, little girl?" said a very cheery voice, just as she reached the door.

Mary stopped crying "Boo-oo-oo" long enough to see that it was the King of Health Land himself.

"I hate it. I hate it," cried Mary, loudly. "Oh, please, sir, I do not want my fortune told." and she began to cry "Boo-oo-oo" more loudly than ever.

"Don't cry, don't cry, little girl," said the King, "you do not need to be everything you have seen in the mirrors."

"Oh, oh, what can I do?" asked Mary, stopping for just a moment to catch her breath. "I do not want to be sick in bed. I do not want to be ugly. I do so want to be beautiful."

"Well, you may be if you will only stop sucking your thumb."

"Then I won't do it again," sobbed Mary.

I do not know just what happened that night, but I half suspect Mary put some red pepper on her thumb. Anyway, she awoke in the morning for the first time without her thumb in her mouth. For several weeks afterwards she went around looking sadly at a huge bandage on her thumb.

Mary said to her friends: "My thumb did not behave itself, so I have sent it to the hospital."

One day she took the bandage off, but she was never seen to put her thumb in her mouth again. Every day she grew more and more beautiful. Her friends began

to call her by her old name, Mary Jackson. Mary Suck-her-Thumb was no more.

The King of Health Land says:

I hope there is no Mary Suck-her-Thumb in your class.

Boys and girls in Health Land put nothing in their mouths but clean food and drink and their toothbrushes.

Sucking your thumb makes you look silly and ugly.

Putting your pencils and fingers in your mouth may make you sick.

Keep your hands away from your face; then they will never get into your mouth.

—*By J. Mace Andress in "A Journey to Health Land."* Ginn and Company, Publishers. Permission of Publishers.

A VISIT TO LOLLIPOP TOWN

One day the King asked the children if they would like to go on a journey to another land. You know how happy they were to go on such a trip.

They started in the early morning as soon as the dew was off the grass. The Healthy-O's had put up the ladders to the high walls, and up scrambled the children.

As soon as they were outside the Health Land they began to make their way through the forest. The King, with his Bugler, took the lead. Often the Bugler played beautiful music on his bugle.

Once they stopped to get a drink of cold water from a spring that bubbled out of a great stone. Then they marched on. The bugle sang out:

"March! March! March!
We're soldiers of the King.
We belong to Health Land,
And all its praises sing!"

At last they came to a hill from which they could see a town in the distance.

"Perhaps you would like to see what kind of town it is," said the King, picking up his field glasses. "Would anybody like to look?"

"I would, Your Majesty," said Olive Green.

And when she looked everything seemed to be quite near.

"Tell us what you see," cried the children.

"It's a queer-looking town," said Olive. "It makes me think of the witch's house in the story of Hansel and Gretel. It looks as if the gate of the town were made of candy. The houses are made of candy. Even the trees have candy growing on them. I see people. They all seem to be sucking lollipops."

"Oh, what a queer town," said the children. "Let us hurry on and find out more about it."

The Bugler blew a blast on his bugle. On they marched, singing:

"March! March! March!
We're soldiers of the King.
We belong to Health Land,
And all its praises sing!"

As they came nearer to the town the King said, "This is Lollipop Town."

It was just as Olive had said. The town seemed to be made of candy. Not only the gate but even the walls of the city were made of candy. The pumpkin vines grew lollipops instead of pumpkins.

At the big gate the bugle again sounded:

"Good morning to you,
Good morning to you,
We're over from Health Land.
Oh, may we see you?"

A little figure at once appeared above the gate. He had a lollipop in his mouth. He took it out of his mouth only long enough to blow on his bugle:

"Enter those who will,
Of lollipops eat your fill."

The King of Health Land and the children walked on to the gate of the town. There was the King of Lollipop Town with a big red lollipop in his mouth. He took it out of his mouth long enough to say "Welcome to Lollipop Town."

He beckoned to several soldiers at the gate, who came forward with several baskets of brightly colored lollipops. "Help yourselves to lollipops," he said, putting his own lollipop back into his mouth.

"Thank you," said the King of Health Land. He turned to the children. "What shall we tell His Majesty, the King of Lollipop Town?"

"Thank you," said the children, "but we eat very little candy, and then only at the end of meals."

The King of Lollipop Town looked surprised. "How strange," he muttered. "I never heard of such a thing. We eat lollipops here any time we want them. Usually that is most of the time. We have more lollipops for food than anything else. Tell me, what kind of a land do you come from?"

"From Health Land," said the children. "We are trying to be strong and healthy."

The children were now inside Lollipop Town. Every child in that town was sucking a lollipop. They, too, offered lollipops to the children from Health Land and were surprised when they did not take any. All the children from Lollipop Town seemed to be pale, weak, and thin.

"I see," said the King of Lollipop Town, taking his lollipop from his mouth, "that your children all seem to have rosy cheeks and to be much better looking than our children. I wonder why."

"I will tell you," said the King of Health Land. "We do not eat much candy, but we drink plenty of milk, eat vegetables and fruits, get many hours of sleep, and do everything we should to make us healthy."

"I think we do very little of that here," said the King of Lollipop Town. "Our interest is in lollipops. After eating lollipops our children do not seem to like milk and the kind of food your children eat. We do not like to go to bed early. We would rather stay up and suck lollipops."

The children went through all of Lollipop Town and wondered at the strange houses built of candy and the trees and vines that were covered with lollipops.

"I think I like our own country best," said Julia Smith.

"Do you see what bad teeth the children have here?" asked Mary Jones. "Perhaps it's because they eat so many lollipops."

"Have you seen enough?" asked the King of Health Land.

"Yes, yes; let's go home," replied the children.

Slowly the group of children walked past the King of Lollipop Town. They bowed to him and said, "We thank you very much for letting us see Lollipop Town."

"Here is a basket of lollipops," said the King of Lollipop Town.

To say this he had to take a big lollipop out of his mouth so that he could talk.

"Thank you," said the children; "Each of us will take just one to eat after our luncheon."

Tramp, tramp, the children filed out through the big gate, along the path to Health Land.

As they looked back they saw the King of Lollipop Town standing near the gate sucking a lollipop. Perhaps he is still standing there.

As for the children they marched on through the woods toward home.

Hear the bugle and the merry voices of the children:

"March! March! March!
We're soldiers of the King.
We belong to Health Land,
And all its praises sing."

The King of Health Land says:

A love of lollipops sends many a child to the dentist's chair and spoils many a good meal.

—*By J. Mace Andress in "A Journey to Health Land."* Ginn and Company, Publishers. Permission of Publishers.

TAILS AND PEARLS

I wonder how many of you boys and girls know any Mother Goose rhymes. Oh! yes, I knew you did, and we all love to hear them and say them. Well, I have a new one for you today that you have never heard before:

Way off yonder—not very far off
A polly-wog jumped up
And his tail fell off.
Way off yonder—not very far off
Jimmy forgot his brush
And his teeth fell off.

I wonder if you know how this little polly-wog lost his tail and how Jimmy lost his teeth. Well, we are going to talk about polly-wogs and little Jimmy for a while. How many have seen a polly-wog? You know a polly-wog baby lives in the mud and water and is just a black spot with a little wiggly tail no bigger than a thread and then it grows bigger and fatter and longer and it gets to be brown and gray spotted and is very pretty with its long glassy tail. Bye-and-bye little feet come out of the body so the polly-wog can jump about in the mud and water. Then it is not long until the polly-wog loses its tail and it becomes a froggie. I wonder how many ever saw a frog. Well, every time you see a frog you can know that it was a polly-wog first, a polly-wog with a little wiggly tail squirming around in the mud and water. After it grew bigger and got feet its tail was of no more use because it became a frog.

Way off yonder
Not very far off
A polly-wog jumped up
And his tail fell off.

When this little polly-wog was born Mamma Frog named him "Woggie" and

she was very proud of little Woggie because as he grew bigger he had the most beautiful tail of all the polly-wogs in the neighborhood.

Now Mamma Frog tried hard to tell Woggie how to take care of his beautiful body, but all she could say was "Croak, Croak," and Woggie could not understand what she meant.

When Woggie began to hop about for himself he began to think he was very smart and he loved to sit among all the Polly-wogs on a high flat stone so that he might show his beauty and make them all wish they looked like him. He even thought he knew more than his Mamma Frog did and did not listen to her "Croak, Croak" as she tried to tell him to be careful of his body so he did not lose his tail before it was time for him to part with it.

Well, one bright sunny morning Woggie decided he would make a journey around the world, and he hoped some day, when he knew all the frogs in the kingdom of Frogland, that they would make him their king.

Now Woggie had not gone very far on his journey when he became very tired. He sat down to rest on a large flat stone. He looked all about him and in a short time he saw all the frogs of Fairy Pond come out croaking their merry songs and telling how mighty their king was.

Foolish Woggie thought, "Ah, here is my chance. When the king comes along with all his kingdom of frogs, I shall show them all that I am the most beautiful and most mighty of all. Then they will choose me for their king."

Very soon the king came and sat sunning himself on a beautiful water lily in the middle of the fairy pond. His people hopped happily about him croaking their merry songs of praise. They had not been singing long when Woggie decided he would jump across the wide pond in one big jump and show them all how much more beautiful his tail was than the king's, and how much higher he could jump than all the other frogs. So Woggie croaked one loud croak and made one big jump into the air. The king and all his people looked and all was very still for a moment.

But poor foolish Woggie. As soon as he jumped, Oh! off came his tail, and he fell with a splash in the middle of the pond. And this is how a silly little Polly-wog lost his tail just because he would not mind Mamma Frog.

Now Frogs and Polly-wogs are not the only ones that lose important parts of their bodies just because they do not take care of them.

Let me tell you about a little boy I knew once. This boy was named Jimmy. When Jimmy was very, very young his mother taught him to brush his teeth three times a day and to help him do so she used to say:

"Brush, Brush, Brush!
Brush, Brush, Brush!
Brush your teeth and start the day
In a clean and healthful way.
After breakfast and dinner too—
This keeps them clean and white for school.
Before you go to bed at night,
Just brush those teeth with all your might.
Then on your pillow your head may rest,
And mother'll be proud,
You've done your best."

Now Jimmy had beautiful teeth. They were so white and looked so pretty

when he smiled that the people called them "pearls." This made Jimmy very happy, and he used to smile most all the time so everyone might see his pretty teeth.

As Jim grew older he began to think it was not necessary to brush his teeth three times a day. And when bed time came he used to slip away into dreamland and forget all about his toothbrush.

It was not long until Jimmy thought brushing his teeth two times a day was too much trouble and took away some of his play time, so he would run off to school with the boys after his noon meal never thinking to shine up his pretty "pearls."

When vacation time came Jimmy was so busy having good times and playing games with the boys that his toothbrush was forgotten altogether. Poor, poor toothbrush.

The people never asked Jimmy to smile any more because his "Pearls" were all gone, and in their place were rusted brown broken teeth. These teeth were rusted and broken and brown because the candies and sweet foods which he ate were never

brushed away. Just because he did not brush his teeth after he ate, the food he left around them made little rusty spots and began to make big brown holes in his once pretty white "Pearls."

One night when Jimmy was tucked away in his clean white bed and dreaming of big juicy apples, a sharp pain woke him up. He screamed and pressed his hand tightly against his cheek, but the pain would not stop. His mother came in and saw him crying. She felt very sorry for him and tried to stop the pain but she could do nothing and poor Jimmy had to cry himself to sleep.

Next morning Jimmy climbed out of bed and ran to look in the mirror to see where the horrible pain in his cheek came from. When he opened his mouth what do you think he saw? Instead of his pretty "Pearls" that he was so proud of he saw rusty, brown, brokendown teeth.

And this is how a silly boy lost his teeth because he was too lazy to mind his mother.

Now all of us want to make people happy by smiling at them. So I am going to show you how to keep your teeth like "pearls" by brushing them. This is the way to do it.

(Toothbrush drill.) —*By Charlotte Greenhood.*

JOHN SPECKLED-TOOTH'S LOSS

It was the third week of the month. The Wide-Awake Health Club was checking up its losses and its gains over the previous month.

"We are now five points behind our record of last month," said Herbert Think-

Well. "Many of the boys and girls have been absent this month. John Speckled-Tooth has been absent most. He was out all last week. If we do not do better for the remainder of the month, Cherry Hill School may beat us; and if we are beaten this month, we have lost everything, for this is the fourth month. We need to win every month from now on to come in ahead on June 1."

"Perhaps John would tell us just how he happened to be absent so much," said Nellie Thoughtful.

John arose in the back part of the room. He looked rather ashamed, as if he wished somebody else might talk. He started once, stuttered, blushed, and sat down.

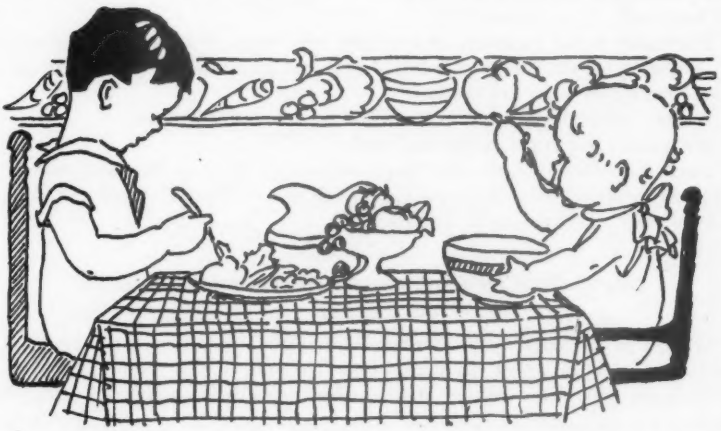
"Please tell us all about it, John," said Miss Content, kindly.

Again John got up. "I-I-I-I am really ashamed of myself," he said at last. "I have had a great loss. I have missed a whole week of school, so I am now way behind, and I missed Jenny Mill's party last Thursday afternoon. Then, too, my being absent so long makes it doubtful whether we can beat the Cherry Hill School this month.

"The worst part of it is this," he went on. "It was all so unnecessary. I had an awful toothache. The dentist said it was an ulcerated tooth. My chin was swollen, and my jaw ached so badly that I could not sleep at night."

"I do not see why you need to be ashamed about that," said Paul Grimyjoe. "Anybody may have the toothache. I have had it many times, myself, and my mother has had it, too."

"I am certain," said John, "it's our own fault if we have the toothache. It served me right to have the toothache. I am ashamed to say so, but I know it's true. I knew better. Maybe if I had kept my teeth clean and eaten the right kind of food and gone to see the dentist regularly, I should not have missed a whole week at school. Both



Dr. Wise and Miss Brown warned me that I would have a toothache if I did not take care of my teeth. I promise you I will not have the toothache again. Hereafter I shall clean my teeth at least twice every day."

"How many did not clean their teeth this morning?" asked the president.

About twenty-five hands went up.

"How many have not seen a dentist for over a year?"

Nearly every hand in the room went up.

"How many do not have a pint and a half to a quart of milk a day, plus at least two vegetables and some fruit?"

At least ten hands went up.

"This looks as if we had something to do," said Billy True. "I have several questions I should like to ask about the care of the teeth. Perhaps some of the other children have questions, too."

Several of the children raised their hands. Miss Content also raised her hand.

"Mr. President," said Billy True, "wouldn't it be a good plan to write these questions on the blackboard?"

"Yes," said Herbert, "Mary is the best writer. I think she will be glad to help."

Mary stepped to the blackboard and wrote the questions one by one as they were asked. These were the questions she wrote:

1. Why should we clean our teeth?
2. What is the best way to clean them?
3. How often do we need to go to a dentist?
4. Do we need to take care of our baby teeth? Why?
5. What is the best way to take care of a toothbrush?
6. What kind of food is good for the teeth?
7. Why do some children have crooked teeth?

"These are all good questions," said Herbert. "We do not have time to answer them today, but I hope every boy and girl in the Wide-Awake Health Club will come prepared next time to answer every one of these questions."

Wide-Awake Boys and Girls say:

Good teeth are a constant joy.

Toothache is not necessary if you keep your teeth clean, eat the right kind of foods and go to see the dentist regularly. Boys and girls with dirty teeth are not good looking even if they wear fine clothes.

We are just as proud of clean mouths as we are of clean hands.

We haven't lost any of our second teeth.

Uncle Sam doesn't want men who have poor teeth for soldiers and sailors.

—*By J. Mace Andress in "Boys and Girls of Wake-up Town."* Ginn and Company, Publishers. Permission of Publishers.

GOOD QUESTIONS ABOUT THE TEETH ANSWERED

"I have in my hand," said Herbert Think-Well, glancing at a paper, "a statement from Dr. Wise about the teeth of the children in this room. Dr. Wise says that there are only three children in this school who have no decayed teeth. Many of us have two or three bad teeth, and some as many as seven or eight. He finds only about half a dozen whose teeth are as clean as they ought to be. Just think of that! To be strong and healthy we need to take care of our teeth."

"Today we are to try to answer these good questions on the teeth," Herbert continued, pointing at the blackboard. "Who is ready for the first question?"

"Mr. President," said Mary O'Right, "the answer to the first question, Why should we clean our teeth? is very easy. John Speckled-Tooth has given us some very good reasons. He did not take care of his teeth, and he missed a party and was so sick for a week that had to stay indoors. His tooth ached so badly that he couldn't sleep at night. If we clean our teeth they will be less likely to decay. Every time we are absent from school because of toothache we lose points."

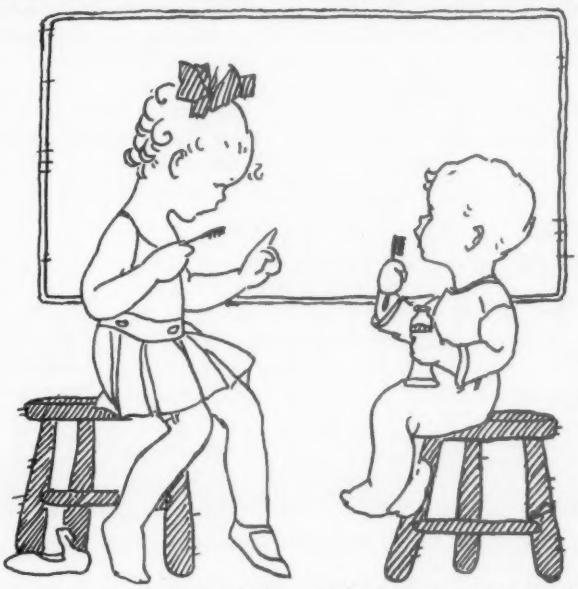
"I think we also need to clean our teeth so that they will be ready to chew our food," said Rose Plumpkins. "If they decay, our food cannot be chewed well. Birds can swallow their food whole because they have a gizzard, where the food is ground up. We need to chew our food."

"There is still another reason that nobody has mentioned," remarked Dorothy Hollbrook. "Clean teeth make one better looking. A boy or girl, no matter how well dressed, cannot look well with dirty teeth. My uncle is a merchant, and he says he would never hire a clerk who has dirty teeth. Customers do not like to buy goods from clerks who do not keep their teeth clean."

"I agree with what Dorothy says, but I think we should add that when teeth are pulled one's face looks funny and very ugly," said Mary O'Right. "I have an uncle who has lost most of his teeth. I do not like to look at him when he laughs."

"The second question," said Herbert Think-Well, "is What is the best way to clean them?" Why-Listen went to the door and opened it. A gentleman with a brown bag stepped inside.

"Oh, it's our dentist, Dr. Sharp," said the president, stepping forward to shake



hands. "The question of how to brush the teeth is so important that I asked him if he would come in and tell us about it."

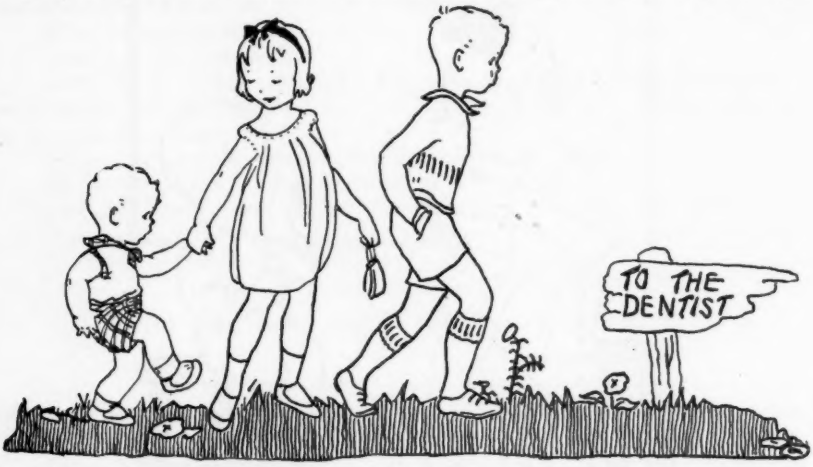
Dr. Sharp smiled, showing his beautiful white teeth. "I am a citizen of this town," he said, "and I like the boys and girls of this town and of this school. I want to do all I can to make you happy and healthy. Then I know you will be at school every day and learn very fast. You may also be expected to play better baseball in June. We need good teeth to be happy."

"The way you brush your teeth is very important. Drawing your brush across your teeth is a poor way, because it does not brush out the particles of food between the teeth and also because it pulls away the gums from the teeth and causes them to decay around their roots. It is a good plan to get a toothbrush with a notched edge like a saw to fit the spaces between the teeth." Dr. Sharp then took a brush out of

his bag. "It is quite necessary to draw the brush so that the bristles will come in between the teeth. Use the up-and-down stroke."

"Let me show you how to do it," he said, raising his toothbrush. "First, I put my toothbrush between my teeth and the upper gum on the left side of my mouth. I put the brush well up on the gums. Then I push it downward to the lower gums and then forward and upward. I do this several times and work around to the front teeth. Then I clean the right side of my mouth in the same way. This cleans the outside of my teeth and the spaces between my teeth."

"Do you need to brush the teeth inside?" asked Nellie Thoughtful. "Yes, indeed, especially the back teeth. The front ones are pretty well cleaned by the rubbing of the food against them, but the back ones get dirty. You take the end of your brush, pointing it the same way as the teeth, and draw it against the tooth, in and out. Do the same with your upper and lower teeth. The biting surfaces are cleaned by drawing the brush in and out across the teeth. After cleaning your teeth it is a good plan



to take dental floss or silk thread and pull it between the teeth. Do not press so hard that you cut the gums."

"Does it make any difference what kind of tooth paste or powder is used?" asked Charlie Slouch.

"Nearly all the toothpaste and powder on the market is good. Remember that it is the brushing that counts most. If you cannot afford to buy powder or paste, use water with a little salt in it, but brush your teeth well. Even with the best of care the teeth cannot be kept perfectly clean without getting them cleaned from time to time by a dentist. But I see there are other questions which you are discussing," said the doctor, glancing toward the blackboard. "Please go on. I would like to listen."

"Mr. President."

"Yes, Anne Gray."

"I think it would be a good idea for us to brush our teeth before breakfast and before we go to bed at night. And after every meal, whether we use a toothbrush or

not, we should try to rinse out our mouths with clean water. This can be done by filling the mouth with water and forcing the water through the teeth. I got all these points from a little book on the teeth," said Anne.

"That is very good advice," remarked Dr. Sharp.

"Perhaps Dr. Sharp would answer the next question for us," said Herbert Think-Well, turning again to Dr. Sharp.

"With pleasure," returned Dr. Sharp; "although you answer your own questions so well, I am not needed. However, this seems to be a kind of question I ought to answer—'How often do we need to see a dentist?' I should say about every six months. If you go as often as that, the dentist will see the decay when it starts, and the filling will be small and cause you little or no pain."

"Thank you, Dr. Sharp," said Herbert. "I have just had my teeth looked over, and I have marked the day on the calendar. Before six months have passed I shall see the dentist again."

"The next questions are 'Do we need to take care of our baby teeth? Why?' Who will try to answer them?"

"What is the use of taking care of our baby teeth?" said Paul Grimyjoe. "We have to lose them, anyway. Isn't it time and money spent for nothing?"

"What does the club think about that?"

"I don't think Paul is right," replied Oliver Straight.

"Why not?"

"Well, we need to have teeth to chew our food. Even if our baby teeth do not last forever, we need them until the others are ready to come in. If they are not kept clean, they will look bad and our breath will not be sweet."

"Oliver is quite right," said Dr. Sharp. "There is another reason also. You know what happens when a rotten apple touches a good apple, don't you?" "It makes the good apple decay, too, doesn't it?" asked John Speckled-Tooth.

"Yes," said Dr. Sharp. "In the same way, a decayed baby tooth by the side of a good tooth of the second set makes it decay."

"I think I can answer the next question, Mr. President," said Peter Stout.

"Very well, Peter."

"After using a toothbrush it should be thoroughly washed in warm water, and then hung in a sunny place, if possible. The sun is a good cleanser."

"Thank you, Peter," said Herbert. "Would you add anything, Dr. Sharp?"

"Only this," said Dr. Sharp. "It is advisable to sprinkle a little salt over the brush if convenient. That keeps the brush clean and helps to make the bristles stiff."

William Tower arose.

"Yes, William."

"I have found something very interesting about the kind of food that is good for the teeth."

"Please tell us all about it."

"I have just read a story about the Indians. They had excellent teeth, although they never used a toothbrush. But they did something that we seldom do. They ate hard, coarse food. An Indian would go off on a long journey with almost nothing but parched corn in his wallet. Such coarse foods scrape the teeth and keep them clean. It also keeps them healthy because they need to work to grind the food. It seems to

me that we eat too much soft food. Much of it needs no chewing. I think we should eat hard toast and coarse food for the sake of our teeth."

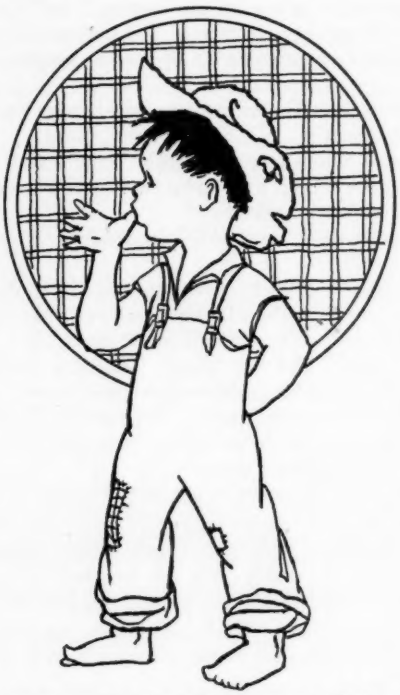
Herbert looked toward Dr. Sharp.

"Excellent," said Dr. Sharp. "I would also like to say that milk and other dairy products, green leafy vegetables, fruits, whole grain cereals and bread are also good for the teeth. See that they are included in your diet each day."

"We have just one more question that I know we all want answered, 'Why do some children have crooked teeth?' "

"Mr. President."

"Yes, William Jones."



"Mother says that one reason why teeth grow out of place is because little children suck their thumbs. I am trying to teach my baby brother to stop sucking his thumb."

"Another reason, Mr. President," said Dick Wells, "is because the first teeth are lost too early. This allows the teeth on both sides to grow over into the vacant space. When the new tooth appears it does not find room enough, so it grows crooked. Keeping your teeth clean and going to the dentist regularly ought to make them clean and straight."

"Have you anything to add, Dr. Sharp?" asked Herbert.

"No, nothing," replied the doctor, "except to tell you what a fine time I have

had here. You are certainly doing some hard thinking on this whole idea of health. May I ask how many of you brushed your teeth this morning?"

Every hand in the room went up.

"Good," said the doctor, "You are just bound to grow up to be healthy boys and girls."

"Before you go, Dr. Sharp, I wish you might hear some of the health rhymes on the teeth that some of the boys and girls have written. Miss Content says they are excellent."

"Thank you, I shall be glad to stay a little longer."

"Nellie Thoughtful, have you one?"

"Yes, Mr. President.

"'Jack,' said Jill, 'I think you will
Agree with what I say, sir.
We'll have to get our teeth fixed up,
Or we shall rue the day, sir.'
"'Jill,' said Jack, 'you're on the track
That leads to health and beauty.
To see a dentist, I should say,
Was our immediate duty.'"

"I have another one," said Nancy Fair.

"Jack Spratt
Is now quite fat,
His wife is far from lean;
I'll tell you why they're round and plump,
Their teeth are white and clean."

"And I have one, Mr. President," said Helen Smiley. "It makes me laugh every time I read it."

"I am certain we all want to hear it," said Herbert.

"This is the way it goes," said Helen.

"There was a crooked tooth
That was allowed to grow;
It pressed against the other teeth
And formed a crooked row.

They made a crooked smile
That twisted out of place
All of which together
Made a homely, crooked face."

A smile still played over Dr. Sharp's face as he waved his hand to the children and turned his automobile toward home.

Wide-Awake Boys and Girls say:

We all cleaned our teeth this morning.

We all clean our teeth before we go to bed.

We use dental floss before we go to bed.

We see the dentist about every six months.

Lazy teeth decay.

We keep our teeth healthy by eating hard food, such as hard toast.

Clean teeth make you beautiful.

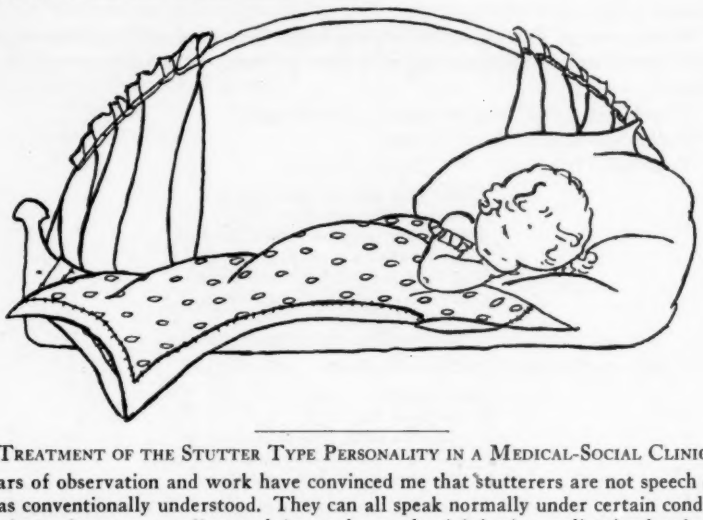
Clean teeth put money in your pocket.

Draw your toothbrush so that the bristles will come between the teeth.

Brushing is worth more than toothpaste or powder.

Take good care of your first teeth or you may have poor second teeth.

—*By J. Mace Andress in "Boys and Girls of Wake-up Town."* Ginn and Company, Publishers. Permission of Publishers.



Treatment of the Stutter Type Personality in a Medical-Social Clinic

Years of observation and work have convinced me that stutterers are not speech defectives as conventionally understood. They can all speak normally under certain conditions. Their intermittent spasmodic speech is not the result of defective oralization but is conditioned in the stutter type of personality by highly emotionalized states of mind. They are agitated human organisms exhibiting a lack of forcefulness and decisiveness. Uncannily, they are moved back and forth across the borderline between emotional balance and emotional imbalance. The stutter type is further recognized by an incoordinated energy output. Their efforts, although numerous, are scattered. They shuttle from one thing to another. The usual result is ineffective social adjustment. All this is surmounted by extreme feelings of inferiority, culminating in chronic fear. Opinions emanating from different points of view are centering on the fact that it is an emotional personality problem. For instance, Blanton, Brown, Solomon, Clark and West say that stuttering is an emotional and personality disorder. Years ago I stated that the problem is centered in the field of human emotions. The adult stutterer usually gives a history of having been a nervous, fearful child, an unduly irritable, excitable child, often living in a psychoneurotic parental atmosphere surcharged with nervous tension. Such is the fertile soil or the agar-agar in which the stutter type is cultured. From early childhood, conflicting emotions rule the stutterer's mind. His normal impulses are inhibited. He is a victim of dread, even terror, so that in the plastic years his doom is practically sealed. His personality development undergoes an ebb and flow that tends toward disintegration. In adult life the fears, morbidities and desolation associated with speech spread into every field of thought and activity. No one knows him as he really is. The attributes of his personality make no impression, because his stuttering is the focal point of interest. In short, stuttering is a pernicious living thorn in the flesh, which numbs the heart, distorts the processes of mind, paralyzes normal impulses with a searing sense of inadequacy, and imprisons human lives in hopelessness and uselessness, forever haunted by the victim's own unbearable sense of futility.—James S. Greene, in *J.A.M.A.*, June 22, 1935.

DENTAL ECONOMICS

COMPULSORY HEALTH INSURANCE AS SEEN IN CURRENT EVENTS*

By E. E. VOYLES, D.D.S., Indianapolis, Ind.

ANY comprehensive study of the issue of health insurance would require space far beyond the limits of this paper. Therefore, my attempt will be to interpret certain current events and present some information which I hope may to some extent make clear the meaning of this controversy. Reference to the political aspects of this subject is necessary to present the issue in its true relation.

Broadly speaking, two classes are represented in the controversy. On the one side, there are the officially constituted bodies of the American Medical Association and the American Dental Association acting through their accredited representatives. As a result of long study and the acquisition of much information, both of these organizations have taken a positive stand against the introduction of "socialized medicine" into America through compulsory health insurance. Opposed to these is a group of foundations representing large endowments. From this source has issued powerful propaganda in favor of health insurance. The lay press has been flooded with sensational articles on the inadequacy of health service and the dire disaster that awaits the professions. Moley's *Today, Survey Graphic, Collier's, The American Mercury* and *Harpers* are the principal outlets. The authors of these articles usually have been I. S. Falk, Edgar Sydenstricker and John Kingsbury of the Milbank Foundation, which is a beneficiary of the Borden Milk Company; Michael Davis, of the Rosenwald Foundation; Mary Ross, of the *Survey Graphic,* the latter partially subsidized by the Milbank Fund; Moley, the original "braintruster," and Abraham Epstein, secretary of the American Association for Social Security and long time exponent of "old age pensions."

To these may be added the Pollak Foundation and the Twentieth Century Fund.

A few dentists have been merciless in their criticism of organized dentistry for its attitude toward compulsory health insurance. Their attacks on organized dentistry have found publication in the proprietary journals and the lay press.

To the foregoing list in favor of compulsory health insurance may be added social workers, technical advisers, job seekers, theorists, politicians and beardless philosophers, who have made a desperate effort in the past few years to sell "socialized medicine" to the American public. Their medium has been the lay press, the radio and the trade dental journals. From last October 1 until February 25 of this year, a series of broadcasts

*Read before the Indiana State Dental Association, Indianapolis, May 21, 1935.

were given over a coast to coast Columbia network by twenty-one speakers representing this group. Their subject was "Doctors, Dollars and Disease." Could it have been a coincidence that these broadcasts and the *Oral Hygiene* poll were timed immediately before the convening of Congress and the several legislatures?

ORAL HYGIENE POLL

Whether purposely or not, the *Oral Hygiene* questionnaire, following this barrage of propaganda, was so worded as to elicit answers favorable to compulsory health insurance. The first question asked was "Do you believe in the principle of health insurance?" which could hardly be answered other than by yes. The question was not asked as to whether one believed that the principle of compulsory health insurance could be practically applied to American dentistry.

The other questions were so worded as to lure the hard-pressed dentists with the prospect of more business. Nowhere in the questionnaire was the problem presented so as to reflect an answer pertinent to the real issue. The same issue of *Oral Hygiene* carried articles favorable to the answers received. No distinction was made in the questions by which the reader would be informed as to what he was really voting for. As I see the poll, it was effective evangelism carefully timed for a purpose, but the results mean nothing except that thousands of dentists want more business. That is a commendable wish, but it sheds no light on the issue.

I question that many of the persons who voted on this poll were familiar with the following facts:

1. A clear distinction must be made between the principle of health insurance and compulsory health insurance.

No system of voluntary health insurance is being advocated by anybody as a solution to the problem of health service. It is agreed that no voluntary plan will work.

2. Any system of compulsory health insurance must reach into the higher incomes in order to remain financially sound. Abraham Epstein, author of the "Model Health Bill," sets $60 per week as the minimum income range to maintain the fund. Incomes of $3,000 a year and under were suggested as the basis for compulsory health insurance by the first report of the President's Committee on Economic Security, upon which the Wagner Bill was based. The Epstein Bill suggests an additional voluntary arrangement for incomes of from $3,000 to $5,000.

John T. Hanks, dental adviser to Harry Hopkins, stated in a recent paper that family incomes up to $3,000 would include 23,290,000 families, which is about 95 per cent of the population.

Thus, it is seen that, under the guise of providing for the health needs of the low income groups, these plans actually regiment the major part of our population under a system in which it is necessary to define and limit the character of service needed. Under the alluring phrase "social security" and the "abundant life," we would be led to believe that "adequate" dental service would be supplied to all the people. It has been estimated that to meet adequately the dental needs of all the people in this country would require six to nine times the number of dentists in America working full time. It just could not be done under American standards and institutions.

3. The type of service must be limited and defined.

To my knowledge, there has so far been no plan advocated to provide adequate care for dental needs. In fact, such

a plan is not practical of application on the insurance principle. Those plans seriously considered provide only for relief of pain, prophylaxis, extractions and silver fillings in the posterior and synthetic fillings in the anterior teeth. Only such service lends itself to actuarial computation. Beyond that, service would reach into cost figures too staggering for consideration.

In England, only 10 per cent of those entitled to dental benefits as a part of the system of "panel medicine" ask for it. No use of roentgenograms and inlays and other high types of service are permitted to be asked for by the patient nor suggested by the dentist under penalty of breach of contract and expulsion. To do so might reflect against the character of service and interfere with the perpetuation of the plan. This character of service lends itself perfectly to a large class of dentists in England. Of 14,000 dentists in that country, only about 3,000 have scientific training such as we know here. The other 11,000 obtained their training through laboratories, apprenticeships and street corner vendors and received their license by act of Parliament when a law was passed regulating dentistry. A similar condition exists in Germany where the *Zahnarzt,* or graduate dentist, is distinct from the mechanical dentist, who is also licensed. We have not that situation in America, which would lend itself to a scheme of mass production of inferior dental work. Nor would we want it, I am sure.

Dr. van Minden, of Chicago, who spent some time in insurance dentistry in Holland and England, stated that the equipment was poor and the work had to be done in a hurry. He does not think the insurance principle can be successfully applied to American dentistry.

Social planners have told me that American dentistry is too scientific. I shall not argue that point, but those are the persons who would administer dental service to 95 per cent of the American people, who would be compelled by law to contribute to it.

4. The indigent and the unemployed are not included under compulsory health insurance. This group is the most urgent social liability, yet they cannot practically be included in such a system.

5. The thrifty must carry the shiftless. Of interest to the insured is the fact that compulsory health insurance is based upon the communistic principle that the fortunate shall divide with the less fortunate. Therefore, the healthy, intelligent, industrious person who acquires a higher income must be compelled in this system to pay into a common fund in order that the greater health needs of the weak, the illiterate, the indolent and the shiftless alike may be taken care of.

6. Compensation of the dentists is inadequate.

In any system wherein the contractual rights are vested in a third party, the dentist's compensation must vary as the supporting fund fluctuates. In a plan that has been suggested with a per capita basis of compensation for the dentist, the sum of $4 per capita per annum has been suggested as the maximum by technical experts. On this basis, if the patient yearly consumes four hours of the dentist's time, which is a minimum estimate, the latter would receive $1 per hour; while a workman fixes plumbing at from $1.25 to $1.40 per hour. The result of such a contract is inevitable: the dentist becomes a plumber to the patient. In fact, that is actually what has happened in Europe. Insurance dentists would not be interested in such scientific lectures and clinics as we are having here today.

The British system of "panel medicine" also was introduced as a political

move, by Lloyd George in 1911. It has had an uneven course. It was hailed as a great improvement over the German system and doctors were lulled into accepting it by the lure of more paying patients. The scale of medical fees started out at $5 per capita per annum. This has been reduced now to $1.75. Dental service is provided only when there is a surplus in the funds of the "approved societies." As has been stated by Dr. Remes, "the lowest standard of dentistry becomes the norm with a premium on mediocrity."

The following is taken from the *New York Journal of Dentistry,* March, 1935: "British doctors unionize in order that 'their hands may be strengthened in negotiations with the British Government.'" The announcement comes from A. Welpy, secretary of the Medical Practitioner's Union of Great Britain, which is now a component of the "Trades Union Congress." I understand that this medical union now numbers about 6,000 members.

7. The history of compulsory health insurance is filled with instances of unending trouble. Neither the insured nor the professions seem to be pleased with it. Constant revision of the law is necessary. From the May issue of the *Hudson County Dental Society Bulletin,* I clipped a report which indicates that the French system which went into effect in 1930 is encountering difficulties and that revision and possible elimination is under consideration.

The German system is the oldest existing government plan. It was introduced by Bismarck in 1883 as a political move to satisfy the Socialist Party. It was started to supply only the needy group and now reaches about 65 per cent of the population and employs 70,000 officials in its administration. It is one of the major departments of state. In many German cities, the "social insurance" buildings are the most pretentious in the city.

Gustav Hartz, labor economist of Berlin, author and former laborer and labor leader, has written a pamphlet entitled "Will America Copy Germany's Mistakes?" He strongly urges compulsory saving instead of compulsory insurance:

> Instead of an insurance card, the workman would have a bank book, the best way of giving him a sense of responsibility. If Germany had no social insurance system, but still had her fifty years' experience in it, she certainly would not adopt social insurance today.

It is Mr. Hartz' opinion that not over 5 per cent of the German people are unable to support themselves, whereas 65 per cent are compelled to come under the insurance system. He says scandals of administration are common:

> Downright corruption adheres to the palace. One scandal follows the other. Administration officials, suppliers, architects were dragged into the mire. Common embezzlement, bribery and other dishonorable acts of officials were unearthed.
>
> Excessive squandering of money; doctors, dentists, chemists even employers were involved as wilful premium defrauders. Pretenders, annuity chasers and illicit workers developed. A network of deception was spread.

He states that corruption grew so common that it became necessary to employ a corps of medical policemen to check against their fellow doctors as well as the patients.

Many state associations have endorsed the stand of the Trustees of the A.D.A. against compulsory health insurance as advocated. No group of organized dentists has endorsed it as such.

In a recent election of officers of the Chicago Dental Society, compulsory health insurance was made the issue. The

result was a complete repudiation of "socialized medicine" in the face of powerful influences in its behalf.

CAN THE PUBLIC AFFORD DENTAL CARE?

As far as I know, no study has been made of what the incomes up to $3,000 are spent for. It may safely be assumed that much of this income is spent for nonessentials which could more wisely be applied to health service. Education, rather than compulsion, should form a basic part of any plan of dental care.

A recently published statement gave the annual American cosmetics and cosmetic service bill as $2,000,000,000, or nine times the public dental bill.

An Associated Press dispatch gave the retail liquor bill in 1934 as over $3,000,000,000, which amounts to $50,000 per dentist, or fourteen times the average gross dental income. It is highly probable that those in the low income groups shared that luxury.

A recent survey in Minnesota showed that, in 1935, a family of four could live modestly but comfortably on $2,000 a year and still have the sum of $323 left for other purposes. It would follow that with an income of $3,000, there would be left $1,323 for other than necessities. It would seem that in all justice some consideration should be given to the rights of these groups of thrifty citizens to live and express their individuality. These groups have always made up the backbone of American civilization.

If only 5 per cent of the German people are necessary dependents, I do not believe that it is a sound policy to make 95 per cent of the American workers medical wards of the state when industry is fighting with its back to the wall for existence and taxation is reaching unbearable limits.

That compulsory health insurance is not the only answer to the problem is evidenced by the practical, constructive program outlined by Colonel Messner in his address this forenoon.

This, coming as it does from the U. S. Public Health Service Department at Washington, would indicate that those best able to judge the health needs of our country are not thinking solely in terms of compulsory health insurance.

CONCLUSION

There is only one dental mind officially organized and properly constituted to make important dental decisions affecting the profession of this country and that is the American Dental Association.

Fantastic theories of the "abundant life" encourage the "gimme habit." I would encourage self-reliance and *give* a a man only two things, a job at good wages and a chance to provide his own dental needs according to his own tastes. That I believe is what the American people want if left to their choice.

I would resist socialistic health schemes, proven unsatisfactory in Europe, and which can only "glorify the shiftless and crucify the thrifty."

808 Odd Fellow Building.

THE ORAL HYGIENE MOVEMENT: ITS RELATION TO PRESENT DAY SOCIO-ECONOMIC THOUGHT*

By R. S. TOWNE, Bismarck, N. D.

PROJECTS intended to improve or promote the public welfare seldom develop spontaneously, but result from the gradual development of a consciousness within the group sponsoring the particular project. Years are often required before this consciousness finally finds tangible expression, but, sooner or later, some individual or number of individuals within the group become sufficiently impressed with the importance of the idea to take an active part in its promotion.

A review of dental literature reveals the growth of such a consciousness within the dental profession. This consciousness, which first found expression twenty-five years ago, through the work of Ebersole in Cleveland, and Fones in Bridgeport, marked the definite beginning of the oral hygiene movement.

Much of the work in the cause of oral hygiene was directed toward the relief of the dental condition of children. The growth of the movement soon became world-wide, and did much to stimulate thought and direct attention to the possibility of the prevention as well as the treatment of dental disease. It helped to broaden the concept of dentistry and assisted materially in projecting the professional viewpoint beyond the horizon of merely repairing defective teeth, and established dentistry as an important factor in health service. It did much to popularize dentistry with the public, and, incidentally, increased the demand for dental service. It made possible contacts and, at times, alliances with school officials, social service agencies, boards of health and legislative bodies. The introduction of these outside influences, primarily intended to promote the oral hygiene movement, has paradoxically created a situation now challenging the atmosphere of freedom which history and common sense have proved to be so necessary for creative achievement, as is so aptly exemplified by more than a century of dental effort.

A review of the past twenty-five years also reveals trends in other fields, especially in social science and in politics, which, coincidentally with the oral hygiene movement, are now beginning to be recognized as influences which, it is said, may affect the future of dentistry as profoundly as any development in dental history.

Sociology is one of the newer sciences. Its greatest growth has taken place during the present century, and it is credited with appraising and evaluating many social problems of our civilization; but sociologists do not necessarily agree on the methods best suited to solve these problems. One school is so overpowered by existing conditions that its members despair of correcting the situation, unless our national life is completely socialized. A second school, and one of a considerable number of members, while denying

*Read before the North Dakota State Dental Association, Grand Forks, May 15, 1935.

socialistic intent, advocates practices which, when subjected to analysis, do not differ materially from the practices advocated by the first school. Another group, not so well organized and less vocal, but nevertheless recognizing the seriousness of the problems, views the situation with hope and confidence. These views are sustained by a long and convincing record of continual improvement in man's condition, because of an inherent urge in man to advance himself. People who support this conviction feel that man's highest goal can best be realized under a representative republican form of government, wherein highest ethical instincts may develop and be applied automatically, unhampered by the restraining hand of multiple administrative processes.

The social consciousness thus awakened soon intruded itself into politics. The cause was championed by many able crusaders, who not being content to fight for the cause of reform on its merits, but seeking an easy way to enthrone themselves by unseating the politicians then in power, promulgated a number of innovations related to the mechanics of government. Although some of the ablest statesmen this country has produced insisted that the proposed measures were direct threats to free government, the dramatic appeal of the crusaders as usual captured the popular fancy, and, as a consequence, the primary election law, the initiative and referendum, the recall and direct election of United States senators are here, and quite capable of fulfilling the cherished hopes of the most exacting demagogue. Thus, practically at the same moment, forces in three different fields were brought to light. Paternal instinct warns that care and caution should be the watchword, especially when playing with politics.

The particular national and international economic readjustment cycle in which the nation is at present involved has quite naturally witnessed the revival of many theories of economics, sociology and government, theories which, during periods of relative prosperity, lie dormant, only awaiting some recurring stress, which seldom, if ever, fails to resuscitate them.

One reason that the present economic depression seems more involved than any similar past experience is the fact that the proponents of these theories are better organized and in a stronger position than at any previous time in our history. This does not mean that the theories are any sounder or more capable of meeting the needs of mankind than during other periods of world history which have seen them tried.

Many statements are being made these days about the beginning of a new age. Such statements may well be challenged. The dawn of a new age has always been preceded by an intermediate interval wherein the theories and ideas which have precipitated the demise of the preceding age have had free rein. This brings on disillusionment and finally the return of sound thinking and wise counsel, which are two prerequisites to constructive action. This is the only kind of action capable of launching anything worth while, especially a project so momentous as ushering in an era of human history.

This transitory or intermediate state which at present seems so confusing, so filled with foreboding, is in reality a great proving ground, whereon theories and ideas are the combatants. If we are to justify our claim to intelligence, we surely cannot fail to heed the experience of similar conflicts in the past, or to enlist our might and resources on the side of sanity and proven worth.

Regardless of how ardently the disciples of revolution yearn for a different

world forthwith, the unbounded ambition, impatience and hasty action which now enthrall them have a rather consistent record of sooner or later thwarting their objectives. The disgrace alone of our great country, with a background of 159 years of unparalleled achievement, being overrun by disciples of defeat, desolation and despair will result in eventually arousing the resistance necessary to clarify the situation and direct us forward once more; for it is hoped that none of us are so wedded to the past as not to be mindful of the possibilities of yet greater things in the future.

As for the immediate future, dentistry must be ever mindful of its obligation. Throughout a hundred years of professional experience, it has to its credit a record of accomplishment which should command the respect and confidence of any group with which it may be called on to cooperate for the purpose of improving mouth health conditions.

It is upon such a record that dentistry should now take its stand, prepared to adapt itself to any reasonable requirement which promises opportunity for a more complete fulfillment of its true destiny.

MEDICAL AND DENTAL BUSINESS BUREAU INCORPORATED, INDIANAPOLIS, IND.

As a means of providing good medical and dental care for all, not through insurance agencies or charity clinics, but through their own organization, the Indianapolis Medical Society and the Indianapolis Dental Society have sponsored a plan whereby the wage earner may secure this service commensurately with his income and ability to pay.

The plan was formulated in May, 1934. The business details are handled by an independent business organization known as the Medical and Dental Business Bureau. It has the endorsement of the Indianapolis Medical Society and the Indianapolis Dental Society and more than twenty of the larger local industries. Tried out for a year on a small scale, the service is gradually being enlarged to include wage earners in all Indiana industries.

Any worthy employe or member of his family who is in need of medical or dental care (hospital service can also be arranged), and who cannot pay cash, may be referred to the bureau with a note of introduction. The bureau investigates the financial, industrial, economic and marital status of the applicant. If the applicant is worthy, he may select any physician or dentist that he chooses, provided the professional man is a member of his respective society.

The doctor sends an estimate of the cost to the bureau. In case of hospital service, an itemized statement is required. If there is more than one bill, the bills are consolidated. The bureau then arranges with the patient a definite plan of liquidation in small installments, coordinating it with his income and ability to pay over a period not to exceed twelve months (except in very special cases). If the total cost for service exceeds the amount that it is determined can be paid under such arrangement, the difference is waived. The bureau also arranges for old medical and dental bills to be paid on the same basis. The patient pays no interest, carrying charge, fee or extra cost. The Bureau deducts 10 per cent of the bill to cover expenses. All members of the Indianapolis Medical and Dental societies are automatically members of this bureau and can utilize its services.

The organizers of the plan claim that the Bureau benefits the public because it provides a means whereby the low wage earner can obtain the best of service from the private practitioner and pay for it in small monthly installments. It prevents the employe from

falling into the hands of unethical or unreliable practitioners and relieves his mind of the worry and uncertainty of financial arrangements at a time when he should least be forced to worry about them. It prevents the necessity of borrowing money at a high interest rate and it gives the patient free choice of physician and dentist.

The plan assures the employer greater efficiency through better health and contentment of his employes. It benefits the members of the medical and dental society by bringing patients to them who otherwise might drift into the hands of unqualified or irregular practitioners. It gives them a definite means of gaging their charges with the patient's ability to pay. It encourages early treatment of disease and discourages procrastination on the part of the patient because of lack of funds.

The Bureau is operated as an independent business organization. Its organizers feel that its success and permanency depend on the initiative, thought, effort and interest put into it from a business man's angle. The activities of the bureau are controlled by an advisory committee made up of two physicians and one dentist appointed by their respective societies.

The officers of the Indianapolis Medical and Dental societies have signed an agreement giving official recognition to the bureau. The societies have borne the expense necessary to make each society member a member of the bureau.

RESOLUTION OF THE INDIANA STATE DENTAL ASSOCIATION

At the annual business session of the Indiana State Dental Association, May 21, 1935, the following resolution was unanimously adopted:

WHEREAS, we are confident that the Board of Trustees of the American Dental Association has given ample study and deliberation to the program of health insurance, and we believe their conclusions and attitude are based on sound and honest conviction; and

WHEREAS, the unanimous decision of this body on the subject of health insurance should be accepted as the nation-wide opinion of organized dentistry; and

WHEREAS, we approve of the dignified and ethical conduct of their procedure; and

WHEREAS, the American Dental Association through its Board of Trustees has adopted the following resolution: (See THE JOURNAL, July, 1935, p. 1256.)

Resolved, that the Indiana State Dental Association approves the action of the Board of Trustees of the American Dental Association and directs that the Board of Trustees of the American Dental Association and all component societies of the Indiana State Dental Association be so advised.

RESOLUTION OF THE TENNESSEE STATE DENTAL ASSOCIATION

The following resolution was adopted by the Tennessee State Dental Association, May 16, 1935, during its Sixty-Eighth Annual Meeting at Nashville, May 14-16, 1935:

WHEREAS, we are confident that the Board of Trustees of the American Dental Association has given ample study and deliberation to the problems of health insurance, and we believe their conclusions and attitude are based on sound and honest conviction, and

WHEREAS, the unanimous decision of this body on the subject of compulsory health insurance should be accepted as a nation-wide opinion of organized dentistry, and

WHEREAS, the American Dental Association through its Board of Trustees has adopted the following resolution: (See THE JOURNAL, July, 1935, p. 1256.)

Resolved, that the Tennessee State Dental Association approves the action of the American Dental Association, and all district societies of the Tennessee State Dental Association be so notified.

INTERNATIONAL DENTAL HOUSE PRONOUNCED FRAUDULENT

June 20, the Postmaster General issued a fraud order against the International Dental House, Chicago Dental House, Chicago Dentists and Dr. G. Maas, Chicago, the fraud order being now in effect, and mail being returned to senders marked "fraudulent."

This information has been made public through the *Daily Postal Bulletin,* issue of June 25, 1935.

"RESOLUTIONS PASSED BY FIRST DISTRICT DENTAL SOCIETY OF NEW YORK, MARCH 2, 1935"*

The following communication has been received by the Secretary of the American Dental Association:

At a regular meeting of the First District Dental Society on March 2, 1935, a set of resolutions were presented and adopted; a copy of these resolutions is attached to this communication.

Certain publicity covering this meeting, more especially newspaper headlines, has conveyed to some a false impression of the purport of the resolutions and of what transpired at the meeting. These resolutions, as may be noted, call for the appointment of a committee to prepare a bill designed to protect the public and the profession in state legislation for more widespread distribution of health service. Obviously, the committee report will be submitted to the society for further consideration. It should be noted that the resolutions do not carry an endorsement or disapproval of health insurance or any other type of socialized dental service. The sole object is to be prepared for legislative action if and when it should arise in New York State. It is not proposed that the First District Dental Society shall inaugurate such legislation.

Nothing that transpired concerning these resolutions could in any way be construed as a criticism of the Trustees of the American Dental Association, nor is the action of the society in conflict with that body.

This communication is being addressed to you because of the erroneous impression created by the reports of the meeting of March 2 and to place the facts before the Board of Trustees of the American Dental Association.

JOHN L. PETERS, *Secretary,*
First District Dental Society of the State of New York,
Academy of Medicine Bldg.,
New York City.

May 9, 1935

*J.A.D.A., 22:878 (May) 1935.

CURRENT LITERATURE

Eruption and Decay of the Permanent Teeth in Primates (Adolph Hans Schulz, Am. J. Phys. Anthropol., 19:489 [Jan.-March] 1935): This paper represents chiefly a collection of information on some relations between age and dentition in monkeys and apes, and thus it furnishes comparative data, needed in the interpretation of age changes in the dentition of man. This article, with a complete bibliography, is about 90 pages in length and, for this reason, only the more adequately supported results will be listed. The deciduous teeth erupt at earlier ages in macaques and gibbons than in the larger apes and at much earlier ages in all apes than in man. The tentative average age of eruption of the permanent teeth reaches, in the macaque, from the second half of the second to (probably at most) the middle of the eighth year; in the chimpanzee, from the end of the third to the end of the tenth year, and, in man, from the beginning of the seventh to the end of the nineteenth year. In all these primates, the ages at which the various teeth appear fluctuate individually to a considerable extent. Not only in man, but also in the chimpanzee and in the macaque, there exists a relatively long resting period before the eruption of the last molars. In all the primates examined except man, the eruption of the first molars is followed by a comparatively long intermission before teeth are added to the permanent dentition. With comparatively few exceptions, the teeth of the lower jaw erupt before the corresponding teeth of the upper jaw, this difference being most constant and pronounced in regard to the molars. A detailed survey of the sequence of eruption of the permanent teeth in monkeys and apes is based chiefly upon the observations on a series of skulls totaling 2,908 specimens. The review of the scattered and frequently conflicting statements of other authors regarding the sequence of eruption of the teeth in primates reveals the fact that many erroneous conclusions in the literature are mostly based upon entirely inadequate series of observations. The sequence of eruption and the numerous correlations between suture closure and dental attrition in the different primate genera are shown more clearly by the article than they could be here. Caries and alveolar abscesses are extremely rare in the deciduous teeth of monkeys and apes. In the permanent dentition, these pathologic conditions become very much more frequent in adult than in young specimens and in old than in adult specimens. By means of preliminary comparisons, it is shown that the pathologic conditions of the dentition of man are in many respects very similar to, and in other respects quite different from, the corresponding conditions in apes and monkeys. The combined data on advanced attrition of teeth and on the gradual pathologic destruction and loss of teeth and of alveolar walls reveal a surprising prevalence of these conditions in simian primates of old age. The dentition begins to break down before the termination of the normal life span, not only in man, but in apes and monkeys as well. A decrease in the normal usefulness of the dental apparatus, brought about by extreme attrition, various dental disease processes and premature loss of teeth, is, in general, more common in the higher than in the lower primates. This suggests the tentative conclusion that the probably general, evolutionary prolongation of the life span of anthropoid apes and man is not accompanied by a corresponding improvement in the durability of the misnamed "permanent" dentition.

ALTON D. BRASHEAR.

Variations of the Middle Meningeal Artery Within the Middle Cranial Fossa (Simon B. Chandler and Clement F. Dere-

zinski, Anat. Rec., 62:309 [June] 1935): A rather common operation on the head involves section of the sensory root of the trigeminal nerve for the relief of intractible pain. Since this artery or one of its branches is closely concerned in this operative procedure, a knowledge of its course and relations is of great value. Observations on 1,200 lateral halves of craniums reveal the following facts: The middle meningeal artery enters the middle cranial fossa through the foramen spinosum in 99.1 per cent of all instances. When the foramen is absent, the artery accompanies the mandibular division of the trigeminal nerve through the foramen ovale. In a few instances, these canals communicate or are separated by a thin spicule of bone. The distance between the foramen spinosum and the foramen ovale varies from 1 to 17 mm. Various other conditions of this vessel were also recorded in this report.

ALTON D. BRASHEAR.

Treatment of Chronic Infection of the Parotid Gland (G. M. Dorrance, Am. J. Roent. & Rad. Therap., 33:803 [June] 1935): A report is given on four cases of chronic parotitis treated with radium, with the following technic: At a distance of 4 cm., with a filter of 4 mm. of lead, from 1,000 to 1,900 mg. hours were given at a sitting. Usually, not more than two treatments were necessary and the most given any patient was 7,000 mg. hours, and this over a two-year period. The author believes the method much better than operation and recommends its use in those cases which do not respond to the usual methods of treatment, such as massage, mouth washes, heat and surgical operation. He also suggests that roentgen radiation might give similarly good results, although he has never tried it. The paper was discussed by Frances Gerber, who mentioned treating cases of chronic infection of the parotid with filtered roentgen radiation. H. H. Bowing outlined a technic using heavily filtered radium surface packs, mapping the field into areas 3 by 4 cm. and applying a universal tube to each field. The tube contains 50 mg. of radium filtered through the wall of the applicator, 0.5 mm. silver, 1 mm. brass and 2 mm. lead, maintained at a distance of 2.5 cm. The treatment time is from six to eight hours per unit area.

GRANT VAN HUYSEN.

Breath Odors from Alliaceous Substances (H. W. Haggard & L. A. Greenberg, J.A.M.A., 104:2160 [June 15] 1935): In addition to the odors which may arise from pathosis in the structures of the mouth or respiratory tract, there may be odors arising with no definite pathologic condition demonstrable. In order to determine the possible source of these odors, the authors studied the source of odors arising from garlic and onion. The presence of essential oils of onion and garlic and their decomposition products in the expired air is the direct cause of odor on the breath. Chopped onion and/or garlic was eaten and also taken in capsules and twenty-four hour comparative studies made on the breath. As no odor was found on the breath after the capsules were swallowed, it was concluded that particles retained in and about the mouth caused the odor. Quantitative studies were also made confirming the foregoing conclusion and demonstrating that the odor cannot be completely removed by mechanical means, brushing the teeth and rinsing with soap and water or by a 30 per cent alcoholic solution. A solution of chloramine (0.3 gm. in 30 c.c. of water) used to brush the teeth and tongue and to wash out the mouth, immediately and completely rid the breath of offensive odor by the liberation of chlorine, which reacts chemically with the essential oils to deodorize them.

HAMILTON ROBINSON.

Nonulcerative Tuberculosis of the Mouth Following Dental Procedure (C. R. Rein & M. H. Feldman, Arch. Derm. & Syph., 31:858 [June] 1935): A case is reported of a 27-year-old woman who developed a small, hard, mass in the soft tissue of the cheek beneath the zygoma about three weeks after infra-orbital procaine injection followed by devitalization and treatment of a maxillary cuspid. Extraction of the tooth failed to reduce the swelling, and it was excised, but recurred in

about two weeks. Histologic examination of the material from a second excision revealed numerous discrete and confluent tubercles in the cutis, and a diagnosis of tuberculosis cutis was made. Roentgenograms of the chest revealed old healed central tuberculosis foci. Ultraviolet radiation (general) was effective in reducing the granuloma. Various possibilities are discussed; i.e., a secondary tuberculosis developing in an area of reduced resistance, an oleoma from the accidenal use of an oily anesthetic solution, which at times may show a tuberculoid structure, foreign body reaction, infection introduced by the needle or drug or neuroma. Three facts point away from tuberculosis: a negative result with animal experimentation (although the inoculant was 8 days old at the time of use); the inability to demonstrate tubercle bacilli in the tissue, and the lack of the usual association of pronounced pulmonary symptoms. The authors believe that this is a case of nonulcerative tuberculosis the development of which was favored by dental intervention.

HAMILTON ROBINSON.

New Syphilitic Dental Dystrophy (Similar to Bud Molar of Pfluger) (E. W. Karcher, Arch. Derm. & Syph., 31:861 [June] 1935): This dystrophy of the first permanent molars has been observed only in cases of congenital syphilis. The diameter of the crown is normal but "the cusps, of normal size, are rolled inward without any shoulder at the crown and give the appearance of being clinched." This is different from the so-called mulberry molar. Karnosh has observed that most of the occlusal surface of the first permanent molar is formed during the first year and the calcium deficiencies at this time produce the greatest distortion. The tooth-forming organs are not seriously impaired *in utero*, and most of the deciduous teeth, as well as the first permanent molar, are well formed in spite of active syphilis in the embryo. Karcher believes this dystrophy is the same as the condition identified as Pfluger's "bud molar."

HAMILTON ROBINSON.

What Shall We Do for the Patient with Trigeminal Neuralgia? (G. Horrax & J. L. Poppen, New England J. Med., 212:972 [May 23] 1935): The authors attempt to answer a number of pertinent questions, basing their answers on their experiences with 500 cases of trigeminal neuralgia. They have carried out 204 radical sensory root avulsions and have given 769 alcoholic injections. In the foramen ovale, 338 deep injections for the third division gave relief for an average of fourteen and three-tenths months; 190 injections of the second division at the foramen rotundum gave an average of twelve and four-tenths months' relief; 167 injections at the infra-orbital branches of the second division gave twelve and two-tenths months' relief, while twelve injections for these branches at the notch gave only six months' relief. Twelve injections of the gasserian ganglion were performed, relief being permanent in total injection and permanent for the peripheral branches corresponding to the area destroyed in partial injection. In no case would the authors recommend sensory root avulsion until at least one alcoholic injection has been made, giving the patient an idea of the numb sensation which must be substituted for pain in case of avulsion and also confirming the diagnosis. The injection is given without anesthetic and the patient usually suffers no more pain than that from a single paroxysm. Since alcoholic injections afford over twelve months' relief on the average, it is preferable to treat trigeminal neuralgia in this way unless scar tissue formation makes injection difficult or the danger of infection arises.

HAMILTON ROBINSON.

Adenolymphoma of the Salivary Glands (R. Carmichael, T. B. Davie & M. J. Steward, J. Path. & Bact., 40:601 [May] 1935): Eight new cases are reported together with twenty-six found in the literature. Since seven new cases have occurred in North England in the last three years, the condition cannot be considered as rare as previously supposed. This tumor, which is benign and slow growing, generally oc-

curs in males, most commonly during the fifth and sixth decades. It appears in the preauricular region or near the angle of the jaw. The duration may vary from a few months to thirty years and the tumor may reach the size of a cherry or an orange having either a soft, firm or fluctuant consistency. Encapsulation is definite except in the presence of malignant change, and enucleation is easy. Subjective symptoms are slight. Section of the growth shows a cystic structure although solid types occur. The spaces contain mucoid or turbid fluid and show a shaggy wall with papillary projections. Microscopically, it is composed of columnar epithelium with a lymphoid stroma and active germ centers. Epithelium lines the cysts and acini and forms acini in the lymphoid tissue. Both constituents show neoplastic change. It is suggested that it originates from duct epithelium and lymphoid tissue which has become abnormally blended during development.

B. G. Bibby.

Choline, A New Vitamin: A new vitamin which is essential for liver function and which may play an important rôle in controlling diabetes was described at the Atlantic City meeting of the American and Canadian Medical Associations by one of its discoverers, Dr. C. H. Best, of Toronto, co-discoverer of insulin. The new vitamin has a real name, choline, instead of a letter as do most other members of the vitamin family. It is found in many foods, but the best sources are meat, egg yolk and yeast. Dr. M. Hershey and Miss M. E. Huntsman, of the University of Toronto, were responsible for many of the fundamental observations that led up to the discovery of the significance of choline, Dr. Best stated. Lack of this vitamin causes the serious condition of fatty liver. When the liver becomes fatty, it fails to make sugar or handle bile or do many of the things it should do. The vitamin was discovered in the course of insulin investigations. Dogs that had no pancreas, the insulin-secreting organ, failed to live for more than a few months, even when given insulin injections. When they were fed minced pancreas, in addition to the insulin, they lived for years. However, chemical studies of the pancreas showed that in addition to producing insulin and a digestive ferment, this organ contained choline, and that it was the choline in the diet of minced pancreas that kept the dogs alive after they had lost their own pancreas. Cases of fatty liver in human beings, a serious condition of ill health, may be due to lack of choline in the diet; but Dr. Best did not discuss this point. The choline discovery has thrown further light on the diabetes problem. The latter condition is a liver disorder rather than a disorder of the insulin-producing pancreas, it now appears. According to Dr. Best "The pancreas is not always to blame in cases of diabetes." Diabetes may be caused in three different ways: the liver, as the result of injury or disease, may become too active and make too much dextrose sugar from the starches, sweets and proteins eaten; or the liver may become overactive owing to lack of insulin (the usual explanation, though not necessarily the usual cause of diabetes); or, finally, the pituitary, thyroid and adrenal glands, either alone or in combination, may become overactive and affect the liver through their relation with the insulin-producing part of the pancreas. The pancreas was evidently at fault in the first case of diabetes treated with insulin, that of Leonard Thompson, of Toronto. Following Mr. Thompson's death from pneumonia in April, 1935, autopsy examination showed remarkably few of the insulin-producing islet cells in the pancreas. This patient, who as a lad was dramatically rescued from danger of diabetes by treatment with some of the first insulin ever produced, grew careless about his diet when he grew older. As a result, he developed diabetic coma and then pneumonia. The physicians were able to relieve the diabetic condition again by insulin, but they could not save him from the pneumonia.—*Science,* 81:5 (June 21) 1935.

Treatment of Arthritis by Diet and Sunlight (L. Langstroth, Calif. & West. Med., 42:145 [March] 1935): Langstroth bases his discussion on 100 cases of chronic

arthritis, describes the degenerative, proliferative and borderline types and states that degenerative arthritis is usually favorably affected, or completely relieved, by proper dietotherapy. In seventy-two cases treated by diet, five were not improved, thirteen were slightly improved, thirty-nine were much improved and fifteen were completely relieved. The dietary history shows that, when a diet high in protective foods is instituted, relief will be most striking in those cases in which the previous inadequacy has been greatest. Bread stood out most prominently in the dietary histories as having a relation to improvement when a proper diet was instituted. Physical therapy is a helpful adjunct to dietotherapy at times. Actinotherapy has a good general tonic effect on the tissues; heat and diathermy are useful in spinal arthritis with referred pain down the arm, and massage of the back muscles is helpful occasionally in spinal arthritis. Postural exercises are particularly important in sacro-iliac disease and arthritis of the spine, but should be used generally after the pain has been controlled by diet. The approach to proliferative arthritis is different. The patient should be allowed what small amount of activity he is able to undertake. The full basic diet of protective foods, or as much of it as can be taken, is given at once. Heliotherapy is almost indispensable in proliferative arthritis, and artificial sunlight is a poor substitute. The patients who have done best are those who have moved into regions where sunbathing is possible for eight months of the year. After the patient is thus established and treatment begun, there is an interval of several months before improvement begins, and during this period every effort must be made to support his morale. When all signs of activity have disappeared in the joints, massage and passive and active movement are begun, being continued as long as there is hope of increasing the range of motion. In the borderline types of arthritis, it is best to immobilize the affected joints in some form of splint until the pain is relieved and then gradually to remove it and institute massage, passive motion and diathermy. When this sort of immobilization is added to the dietotherapy and actinotherapy, such a joint will often be restored to full function in a few weeks. While improvement has been marked in both types of arthritis under the treatment outlined, any relaxation of vigilance as to diet in the degenerative group, or rest and sunlight in the proliferative group, will soon bring on symptoms. The author concludes that he has succeeded in arresting the progress of the disease or in restoring painless function, but he cannot say that he cured it in any sense, for the old environmental conditions will allow it to progress again.—*J.A.M.A.*, 104:1942 (May 25) 1935.

Experimental Studies in Alcoholism (R. Fleming and E. Stotz, Arch. Neur. & Psych., 33:492 [March] 1935): Fleming and Stotz studied the distribution of orally ingested alcohol in the blood and cerebrospinal fluid of fifty-two subjects in order to determine whether differences occur that can be correlated with differences in the clinical picture or in drinking habits. The volume of alcohol ingested was 0.6 c.c. of absolute alcohol in a 20 per cent solution per kilogram of body weight. The chemical method for the determination of the alcohol was based on Nicloux's principle. The method was modified for use with the Folin blood filtrate. The experimental subjects consisted of eight patients suffering from schizophrenia, eight having delirium tremens, nine manifesting alcoholic hallucinosis, nine having syphilis of the central nervous system, two cerebro-arteriosclerotic patients and a manic-depressive psychotic (depressed) patient. Fifteen of the cases were without psychosis. According to drinking habits the subjects were divided into three groups: twenty-five heavy drinkers, fifteen moderate drinkers and twelve abstainers. Comparison of composite graphs showed that in heavy drinkers the alcohol of the blood rises more rapidly, reaches a higher maximum and falls more quickly than in abstainers. The values for moderate drinkers occupy an intermediate position. In the cerebrospinal fluid the alcohol rises more rapidly to a higher peak

and falls more quickly in the heavy drinkers than in the moderate drinkers, while the curves for the abstainers occupy an intermediate position. No correlation could be demonstrated between the clinical picture and type of curve. The composite curves for the alcoholic psychoses resembled those for the heavy drinkers, and those for the schizophrenic group approached the form in the group of abstainers. The general drinking habits of each group seem to determine the shape of the composite curves.—*J.A.M.A.*, 104:1940 (May 25) 1935.

Adamantinomas of Hypophyseal Stalk and Sphenoid Bone (H. Zeitlin, Am. J. Cancer, 23:729 [April] 1935): Zeitlin reports three cases of adamantinoma. The structures presented in the first case were suggestive of enamel formation, consisting of epithelial cell layers, which were arranged similarly to the pattern found in the enamel organ. The outer layer was composed of columnar cells having a characteristic palisade formation corresponding to the ameloblasts or gonoblast cells of the enamel organ. Immediately beneath the gonoblasts were several rows of flattened cells, the axes of which lay at right angles. The innermost layer of cells consisted of star shaped or stellate cells with protoplasmic bridges forming a reticulum. Epithelial pearl formations were present throughout. Toothbud-like projections were seen sprouting from the epithelial cells. Although there were some structures that resembled enamel-forming cells, they showed considerable deviation from the normal. The elongated rod cells seemed to arise from the masses of epithelial cells and not directly from the ameloblasts. From the gross description of the second case, it is evident that the tumor arose from within the body of the sphenoid bone, filled the sphenoid sinus, extended into the posterior part of the roof of the left orbit, left middle ear and right internal jugular vein, and invaded the posterior lobe of the hypophysis, eroding through the dura and giving local metastasis to the infundibulum. This case therefore gives distinct evidences of a malignant character. In these malignant types of adamantinoma the erosions of the sphenoid bone and the infiltration of the dura and the base of the brain are usually conspicuous features. The third case may be considered an intracystic papillary adamantinoma. The character of this tumor was determined by the interlacing epithelial columns lined by a single row of cuboidal cells, the central masses composed of stellate cells with a tendency to form whorls, and the calcareous deposits and numerous cyst formations. Keratohyaline granules were not demonstrable in any of the tumors. The significance of these granules in differentiating the tumors under discussion from epitheliomas of the skin, as emphasized by Erdheim and Jackson, can no longer be maintained. Hair follicles, sebaceous glands and sweat glands, described by Bostroem, Globus, Shapiro and others in epidermoid cysts simulating hypophyseal duct tumors, were likewise absent in these cases. Depending on the stage of formation and differentiation of the oral epithelium, the epithelial cells vary in the formation of the enamel organ. Hypophyseal duct adamantinomas are more common in children and adolescents. The author's first patient was 3 years of age. The clinical picture varies with the location of the tumor and with the age of the patient. The symptoms are largely those of intracranial hypertension, disturbance of hypophyseal function and compression of the neighboring structures. Compression of the optic chiasm is the cause of optic atrophy, defect in the visual fields and visual disturbances. In the 3 year old child there were no marked evidences of pituitary disturbance or pressure on the hypothalmic region except possibly her precocious intelligence. In the second case the scantiness of the pubic hair and the diagnosis of the tumors of the hypophyseal duct rests largely on the suprasellar calcification, which is often detectable on roentgen examination. It is present in the majority of the cases and, when typically developed, is of great diagnostic significance; in fact, it may be considered pathognomonic.—*J.A.M.A.*, 104: 2125 (June 8) 1935.

Diseases, Malformations and Injuries of the Mouth and Associated Parts Occurring in Children (Malcolm Wallace Carr, Internat. Clin., 4:233 [Dec.] 1933): Oral pathologic conditions, in an attempt to correlate the principles of oral surgery with the practice of pediatrics, may be divided as follows:

1. Primary infection and inflammation of the soft tissues of the mouth: (a) Inflammatory reaction of deciduous dentition in the majority of healthy children produces little or no disturbance. Lancing of the gums is contraindicated. (b) Periodontal disease, often associated with the deposition of subgingival salivary calculus. This may constitute a focus of infection. (c) Aphthous stomatitis is treated with silver nitrate, 10 per cent. (d) Ulcerative stomatitis—the result of poor hygiene. (e) In gangrenous stomatitis, the destruction of tissues extends deeper than the mucous membrane. There may be massive destruction of various structures of the mouth, with diffuse cervical adenitis. The mortality is 50 per cent. (f) Noma (cancrum oris) is a progressive gangrene which occurs between 3 and 12 years. It is probably due to vascular thrombosis caused by invasion of Vincent's organism and is usually fatal. (g) Vincent's stomatitis may be complicated by fusospirochetal infections of the eye, ear, mastoid, sinuses and lungs. (h) The certain diagnosis of thrush is made microscopically. Boric acid therapy is effective.

2. Oral manifestations of systemic disease: (a) Local lesions manifest before systemic disease in the acute exanthems, leukemia and agranulocytic angina. (b) The ingestion of drugs, such as mercury, bismuth and arsphenamine, produces stomatitis. (c) Oral lesions in specific diseases, such as syphilis, tuberculosis and actinomycosis. (d) Oral lesions in diseases of dietary deficiency, which are typified by rachitic teeth.

3. Infections of the teeth, periapical regions and adjacent tissues: (a) Dental caries consists of the chemical solution of calcium salts by lactic acid, followed by decomposition of the organic matrix. Diet and nutrition are important factors. Prophylactic care and treatment of deciduous teeth are necessary to prevent serious infection and malocclusion. (b) Chronic periapical disease produced by the passage of infection through the apex. This is usually due to the streptococcus. (c) Acute dento-alveolar abscess may burrow in different directions and may perforate into the mouth or nose or terminate in acute cellulitis or osteomyelitis.

4. Abnormalities of growth and development: (a) Malocclusion. Moderate irregularity of the teeth anterior to the first permanent molar is usually corrected spontaneously. Untreated malrelations between maxillary and mandibular first molars are followed by malrelation of jaws. Adenoids are an important factor. Early orthodontic treatment is imperative. (b) Supernumerary teeth should usually be removed. (c) Impacted teeth should usually be treated conservatively. Room for eruption may be provided by orthodontic appliances. If the teeth are only partially erupted, they should usually be extracted. (d) Harelip and cleft palate.

5. Benign and malignant tumors: (a) Hypertrophy of the gums—possibly a deficiency disease. (b) Epulis, a benign, giant cell sarcoma, does not metastasize. It is cured by removal. (c) Sarcoma is the most frequent malignant growth arising from the mouth or maxillary bones. (d) Benign odontoma of several types arises from embryonic cells.

6. Traumatic injury: (a) Fracture is the most common injury. It is treated by reduction and immobilization.—*Am. J. Dis. Child.*, 49:1336 (May) 1935.

Amidopyrine and Granulopenia (L. R. Limarzi and Iva G. Murphy, J. Lab. & Clin. Med., 20:616 [March] 1935): Limarzi and Murphy report a case of recurring granulopenia in which there were recoveries from four attacks. In all four, there was granulopenia and in three a leukopenia. Analysis of the differential blood counts shows that the case was one of granulopenia and differentiates it from aleukemic lymphadenosis and aplastic anemia. Recovery from the first attack

followed a blood transfusion that was associated with a severe immediate and delayed reaction. Recovery from the second and third attacks occurred spontaneously. Recovery from the fourth attack occurred after the administration of yellow bone marrow and liver extract (by mouth and parenterally). In the fourth attack large doses of amidopyrine (a total of 370 grains, or 24 gm.) were administered during the malignant phase and were continued into the recovery phase, showing that it was not possible to depress the granulocytosis by the administration of amidopyrine. Since recovery from the last attack, doses of 15 grains (1 gm.) of amidopyrine have been given without influencing the total or differential white count. The amidopyrine patch test was negative.—*J.A.M.A.*, 104: 2033 (June 1) 1935.

Uncommon Congenital Anomalies (M. Cooperstock): I. Miscellaneous Cases.—The tendency for congenital anomalies to occur multiply is well recognized. The obvious presence of one anomaly should stimulate a search for others. Occasionally an infant is born with an unusually large number of congenital abnormalities, as is illustrated by the following cases: Case 1. —A premature infant has harelip, cleft palate, absence of both thumbs, bilateral fusion deformity of the humerus and ulna, bilateral clubfeet and hypospadias.—*Am. J. Dis. Child.*, 49:1375 (May) 1935.

Functional and Developmental Space Retainers for Loss of Deciduous Teeth (Richard C. Mears): The functions of the deciduous teeth are: (a) to act as organs of mastication, (b) to aid in the development of the mandible and maxillae, (c) to guide the permanent teeth into the correct position, (d) to maintain a correct relationship between the mandible and maxillae until the permanent teeth erupt, (e) to aid in the muscular development of the face and (f) to aid in enunciation. For these reasons the deciduous teeth should be preserved until exfoliation. Children should be taken to the dentist when the first dentition is complete and periodically thereafter. Cavities in deciduous teeth should be filled if there is no pulpal involvement. Teeth with exposed pulp chambers should be extracted whether they are causing the patient discomfort or not, as they are a source of focal infection. Children with infected teeth have a lowered resistance, are irritable and cannot masticate their food properly. Impairment of the function and development of lost teeth is corrected by artificial replacements in the form of bridges or plates. These appliances are the best known substitutes for natural teeth and prevent later disorders, namely, those resulting from improper mastication of food, lack of bone and muscular development of the face and orthodontic appliances. Discussion—(Philip S. Barba): Dr. Mears has done very interesting work with these appliances. I saw one boy who lost weight for a couple of years, with practically no mastication at all, who ate strained vegetables and ground beef. After Dr. Mears put in plates and dentures the boy became very different and gained weight. Several other patients have shown definite improvement, not so much in weight as in a substantial increase in tissue tone and the general condition. The surprising thing is the way that the appliances work. I was a little skeptical at first about the child's ability to keep them in place and in the ability to handle these children. It seems to have worked out very well. There is practically no trouble in getting the children to take care of the appliances themselves. They are interesting to me as a practical preventive because I have had great expense getting my own children's teeth straightened. I think something of this kind should be encouraging in keeping the child's mouth clean. We have all seen cases of abscessed teeth and draining fistulas with toxic symptoms as a result of abscessed teeth. Anything that will encourage the removal of the diseased teeth, shape the jaw and space the second teeth is a great help in the development of the child's nutrition. Dr. Mears is to be congratulated on developing the work.—*Am. J. Dis. Child.*, 49:1369 (May) 1935.

Evaluation of Dinitrophenol as an Aid in Weight Reduction (J. M. Strang and Frank A. Evans, J.A.M.A., 104:1957 [*June*

1] 1935): Six patients were studied over periods varying from fifty-four to 115 days. They were all women in good health, varying from young adult to middle age. Basal metabolism determinations were made as a routine twice a week. The results were tabulated on the basis of (1) stabilization period of maintenance diet without drug, (2) maintenance diet plus dinitrophenol and (3) maintenance diet without drug. The reduction diet period was composed as follows: (1) reduction diet alone, (2) reduction diet plus dinitrophenol, (3) reduction diet alone, (4) reduction diet plus dinitrophenol—three patients only, (5) reduction diet alone—three patients only, (6) reduction diet plus dinitrophenol—one patient only, (7) reduction diet alone—one patient only. Basal metabolism graphs and weight change tables are given, with close observations of individual changes. The conclusions reached are: The rate of true weight loss in obesity is determined by the difference between the intake and the output of energy; the influence of dinitrophenol on the negative energy balance is small in comparison to what can be secured by even moderate diets; the practical value of dinitrophenol as an aid in weight reduction is very questionable and, in view of the toxicity of the drug, its widespread use for this purpose should be discontinued.

T.

Hypophysis and the Teeth. III. Changes in the Rat Molar Following Hypophysectomy (Isaac Schour, Angle Orthodontist, 4:205-222 [July] 1934): The effect of hypophysectomy on the molars of the white rat has been studied in twenty-three completely hypophysectomized rats (sixty-three to 459 days after the operation) and sixteen litter-mate control rats, in respect to rate of eruption and gross and microscopic alterations. The findings were: 1. Retarded eruption. 2. Distortion of form in the apical portion of the roots. 3. Persistence of juvenile characteristics; shorter length of roots and wider pulp chamber, pulp canal and apical foramina. 4. Histopathologic changes. 5. Disturbances in calcification. 6. Vascular disturbances. The data throw interesting light on various phases of the development and eruption processes of teeth.

T.

Granulocytopenia, with Especial Consideration of Causal Significance of Amidopyrine and Similar Preparation (I. D. Stein, Schweiz. med. Wchnschr., 65:353 [April 20] 1935): Stein thinks that granulocytopenia is not so much a disease entity as a pathologic reaction to certain irritants. He differentiates three groups of such irritants. Those belonging to the first group, benzene, radium rays and roentgen rays, regularly impair the leukopoietic system. To the second group of irritants belong the toxins of typhoid, measles, influenza and sepsis. These toxins attack the leukopoietic system peripherally as well as centrally. The third group of irritants are certain chemical preparations, such as amidopyrine, which, however, prove harmful only in persons who have a hypersensitivity. The author thinks that amidopyrine and its derivatives are the cause of many cases of agranulocytosis that formerly were considered as cryptogenic or idiopathic. He emphasizes that if the physician prescribes such preparations, he should be aware of the fact that there are patients who are hypersensitive to these substances. Thus it is necessary to exercise the same precaution in prescribing amidopyrine and the related preparations as in prescribing arsphenamine and narcotics. The author regards the administration of pentnucleotide and repeated blood transfusions as the best therapeutic measures during the beginning stage. Later, roentgenotherapy may be applied to the long bones and liver therapy may be tried. All medicaments, with the exception of those that stimulate the leukopoietic system, should be discontinued during the acute stage, for it cannot be foretold how a person's blood system will react to a certain medicament.—*J.A.M.A.*, 104:2218 (June 15) 1935.

Development of the Mandible (S. Wilson Charles, D. Rec., 55:297 [June] 1935): Charles gives the embryology of the mandible and the tooth germs from the first evidence of calcification. He compares the processes in the mandibles of the pig

and the child. He says the human mandible grows primarily by addition to the condyle, the bone in front of the condyle and behind growing in such a manner as to maintain continuity. The teeth and alveolar ridges are always in a state of movement in a forward, upward and outward direction. The suggestion that the arch formed by the successional teeth is the same as that formed by the deciduous teeth is incorrect except as to length. He emphasizes that the teeth are in constant movement relative to the main line of the growth of the mandible.

T.

"Spontaneous" Fracture of the Mandible Following Dental Extraction (Evelyn Sprawson, Brit. D. J., 58:555 [June 1] 1935): The author lists the usual causes of so-called spontaneous fractures apart from the one discussed. In the cases reported, no thought of fracture was entertained at the time of extraction. The unlooked for sequelae are a septic painful socket, the infection apparently through a vertical or oblique segment of the mandible followed by necrosis.

T.

Operation for Congenital Harelip and Cleft Palate (Hans Pichler, Wien. klin. Wchnschr., 47:70 [Jan. 19] 1934): Pichler notes that in 1931 a book by Veau appeared in Paris concerning cleft palate. A second book by one of his students, Plessier, treated of harelip. Veau's methods appear to the author to be such a distinct advance that he discusses them in detail. He used these methods in forty-three cases of congenital harelip and cleft palate. The success obtained was so much greater than by other methods that it can hardly be looked on as a coincidence. For example, among sixty-six patients with cleft palate who were operated on according to Langenbeck's method and similar methods, 32.9 per cent were cured after the first operation, and 52.3 per cent were partially cured. Among forty-three patients who were operated on by Veau's method 74.4 per cent were cured after the first operation, and 20.9 per cent were partially cured. Pichler states further that since he became acquainted with Veau's method, he regards all other methods as of historical interest only.—*Am. J. Dis. Child.*, 49:1365 (May) 1935.

Child Welfare Movement in the United States (J. H. Mason Knox, Jr., Rev. franç. de puéricult., 2:48 [Feb.] 1934): Child welfare work in the United States is performed by numerous agencies: the United States Public Health Service, the federal Children's Bureau, the state bureaus of child hygiene and analogous institutions in all the large cities. Several important private foundations contribute largely to the work. Prenatal care is easily available for children of the upper economic strata and for the poor in cities. It is children of the lower middle class and those in rural districts who receive inadequate prenatal care. In certain states, much is being done to improve this situation. The reduction of infant mortality is a satisfactory result of the measures taken for child hygiene in the United States. This result has numerous factors, in particular, the qualitative improvement in the milk, the extension of the supervision of infants by doctors and nurses and the greater interest which parents take in these questions.—*Am. J. Dis. Child.*, 49:1366 (May) 1935.

Normal and Pathologic Lead Content of the Teeth of Man and Animals (F. Pfrieme, Arch. f. Hyg., 111:232 [Jan.] 1934): Lead is present in the teeth of all normal persons. The average lead content of the teeth of fifty-seven normal persons was 0.135 mg. per hundred cubic centimeters. In three cases of lead poisoning the average was 0.42 mg. The lead content of the teeth is negligible in the very young and increases progressively with age. There is no lead in the tartar of teeth; traces are present in the enamel, but most of the lead is present in the dentin. Sex and place of dwelling are not factors. The teeth of carnivorous animals contain the most lead, those of omnivorous the second largest amount and those of herbivorous animals the least.—*Am. J. Dis. Child.*, 49:1367 (May) 1935.

Congenital Neurofibromatous Macroglossia (H. Müller, Centralbl. f. allg.

Path. u. path. Anat., 57:55, 1933): This rare condition was found in the body of a boy, 6 years old, who was mentally retarded. Over the entire body there were numerous nevi, some finely and some coarsely pigmented. There was also a tumor of the right side of the dorsal third of the tongue. In the tongue the papillae were enlarged, and scattered in the muscle were pinhead-sized nodules and strands of gray-yellow tissue. The nodules contained medullated nerves in their central parts, but no ganglion cells. The muscle about them was loose.—*Am. J. Dis. Child.,* 49: 1351 (May) 1935.

Granulocytopenia Following Medication with Amidopyrine (B. von Bonsdorff, Klin. Wchnschr., 14:465 [March 30] 1935): Von Bonsdorff reports the history of three patients with granulocytopenia. In two cases it was virtually certain that medication with amidopyrine was the cause, and it was probable in the third case. In some persons a few small doses of amidopyrine elicit a granulocytopenia, while in other cases it appears suddenly some time after large doses of the substance have been administered without causing disturbances at the time of administration. This shows that therapeutic doses of amidopyrine in sensitive persons may have a detrimental effect on the general condition and on the hematopoietic organs. The action on the granulocytopoietic apparatus is stimulating as well as inhibiting. The total number of granulocytes decreases, but the immature and young forms increase. In some instances, leukocytosis may follow. Amidopyrine influences the organs that produce the monocytes and lymphocytes as well as the erythropoiesis. The changes disappear spontaneously when medication is discontinued. However, it may be assumed that the continuous use of amidopyrine may eventually cause grave clinical symptoms. Animal experiments proved likewise that the administration of amidopyrine or of related substances may eventually impair the hematopoietic organs and lead to leukocytosis, leukopenia or anemia. Moreover, amidopyrine tolerance tests on persons who have had granulocytopenia indicate that amidopyrine may lead to granulocytopenia.—*J.A.M.A.,* 104:2042 (June 1) 1935.

Relation of Periapical Dental Foci to Cervical Tuberculous Adenitis (Pierre V. Gunten, Rev. Mens. Suisse d'odontol., 44, December, 1934): This interesting work was done at the Polyclinic of Professor Veyrasset of Geneva. It deals with chronic adenitis in seven adults and eleven children. The author maintains that chronic cervical adenitis may be provoked by periapical dental lesions without any clinical manifestations—as another form of focal infection. A lymphatic relay carries the infection to its new position. Gunten studied the pus from the cervical lesions, finding it to be sterile, and when guinea-pigs were inoculated with it, it produced no tuberculous lesions. It is often difficult to differentiate between tuberculous and nontuberculous forms of infection of cervical lymph glands when the examination is made by clinical methods.—*La Rev. de Stomatol.,* 37:343 (May) 1935.

T.

Facial Pain in Relation to Stomatologic Practice (J. Tellier and P. Beyssac, La Rev. de Stomatol., 37:328-337 [May] 1935): The authors discuss the question of facial pain from a clinical and practical point of view. They follow the classification given by Alajonanine and Thurel for the general forms of facial pains. There are four types: 1. Neuralgias of trifacial nerve, essential neuralgias, etc. 2. Facial sympathalgias, multiple in topography and etiology. 3. Pains symptomatic of trifacial lesions. 4. Facial psychalgias, including what Sicard described as "neuralgism." The postulate is then advanced that dental lesions are very frequently found to be the cause of trifacial neuralgias. This fact seems to have been ignored or not known by practitioners, with unfortunate consequences for the patient. All patients having painful symptoms in the face should be submitted to a careful examination of the dental system. The dental symptoms which most frequently cause pain are: 1. Pulpitis (acute, chronic with or without intrapulpar nodules). 2. Peridental lesions, gingival

lesions, acute or chronic periodontitis. 3. Impacted teeth. In the past, a large number of cases have been classified as "cryptogenetic" painful syndromes of face. This number may be reduced if dental examinations become a routine procedure.

T.

Hypophysis and the Teeth. IV. A Case Report of a Hypopituitary Patient (Isaac Schour, A. G. Brodie and E. Q. King, Angle Orthodontist, 4:285-304 [Oct.] 1934): The patient, at the time of admission to the hospital, was 16 years old. Examination showed that he was a well developed person with the general appearance of a 9 year old boy. The genitalia were small and infantile. The clinical diagnosis was anterior pituitary insufficiency and dwarfism. The dental and cephalic changes observed were: 1. Very marked retardation in the development and growth of the cranium and face. 2. Class I malocclusion of a mildly unusual type. 3. Prolonged retention of deciduous teeth. 4. Delayed eruption of permanent teeth. 5. Persistence of juvenile dental characteristics, smaller size of roots, parallel pulpal walls, wide pulps and wide apical foramina. 6. Disturbed contour in root surface and pulpal outline. 7. Histopathologic changes in the dental tissues. 8. Disturbances in calcification. The conclusions reached by the authors were as follows: 1. On the basis of such records as are usually taken by the orthodontist, there was not sufficient evidence to warrant a diagnosis of an endocrine disturbance except for the possible significance of the changes noted in the forms of the tooth roots. Only further work will reveal whether or not these are characteristics of hypopituitarism. 2. We have great need for earlier diagnostic criteria in order that treatment may be more promptly instituted. 3. Only the careful recording and publishing of observations on a number of similar cases will reveal whether there is a definite dental syndrome associated with this condition. 4. Definite knowledge of endocrine activity is so meager at present that orthodontic treatment from this standpoint is contraindicated.

T.

MISCELLANY

BOOK REVIEWS

Optimum Health. By Adelle Davis, Consulting Nutritionist. 247 pages. Price, $2.50. Published by California Graphic Press, Los Angeles.

This is one of the most interesting volumes on the subject of diet, the vitamins and nutrition generally that have been encountered for some time. The very first sentence in the book is typical of the apparent common sense approach that the author makes to the ideas advanced. "Everyone should have a sound fundamental knowledge of nutrition which would be so much a part of himself that he would apply it without conscious effort in his every day life." And to this end the author directs her attention very clearly and attractively. The book is not by any means hard reading, and whether or not anything startlingly new may be found in its pages, the fact remains that the ideas are presented in a systematic and lucid manner with no dull or desultory observations to mar the work.

Naturally, the dental mind gravitates to the chapter "Prevent tooth decay," and here is found much of the routine recommendation that has been published from time to time in the literature. There are many sensible observations on the subject of diet that will bear reiteration, but the author falls into the prevalent error of assuming that the whole solution of dental caries is encompassed by the question of diet. Undoubtedly, diet is an important

element in the incidence of dental decay, but it is not by any means the whole story. The assumption that the character of the tooth structure may be materially modified by diet after the tooth has been developed and has entered the mouth is questionable. Teeth do not grow "hard or soft" at the beck and call of diet, as would be assumed by some of our dietitians. This does not mean that diet is not important, but that diet does not change the tooth structure itself in a way to materially modify the carious process. It is more readily conceivable that diet may change the environment of the teeth and thus influence the tendency to caries, than it is to assume that it can alter the character of the tooth structure itself after it is once formed. This observation need not be construed as minimizing the importance of diet or the desirability of its further study.

That the author of this volume has read widely on the subject of nutrition is indicated by the extensive references at the end of each chapter. To follow these references would be to gain a very comprehensive grasp of the subject to date, though it can hardly be said that all of the references are wholly authoritative. At least, this book gives a glimpse of many of the significant agencies in nutrition as related to diet, and it is all presented in an attractive and readable form.

Paying Through the Teeth. By Bissell B. Palmer. Published by the Vanguard Press, New York. Price, $2.00.

Dr. Palmer says "So much has been written and voiced about the relation of good teeth to health, and of diseased teeth to illness, it would seem to be a public service to separate the scientific facts from the fiction of advertisement writers and radio announcers." And this he does, with an ease and clearness that makes what to most would be a dull narration of facts the pleasantest possible reading.

The book, the first of its kind to appear, is complete and so convincing that, should its distribution be extensive enough, no other would be necessary. The place it essays to fill has been left singularly empty. It supplies what sporadic radio talks could never supply—clear, sustained, logical, authoritative information on a subject that has been distorted, misstated, garbled and presented to the public with preposterous phrases and lying claims. This book opposes itself to the millions spent to create fear and appeal to pride, to promise the impossible and deceive the suffering.

It is difficult to select chapters for particular emphasis. Each is so necessary to the whole and so convincingly written that it demands its place. Owing to the obtrusion of advertisements today, those dealing with dentifrices and the dentifrice industry, tooth bleaches, tooth pastes, tooth powders, mouth washes, antiseptics and pyorrhea remedies seem the most deserving of attention. They meet a public need. The author analyzes their contents and claims, quoting the Council on Dental Therapeutics of the American Dental Association and federal authorities. He discusses seventeen tooth pastes, nine tooth powders, fourteen mouth washes and thirteen teething lotions.

The chapters on the dental profession and quack dental remedies and the federal food and drugs act are instructive to dentists generally as well as to the public. In the former is a short history of the movement against quackery in both medicine and dentistry, a list of the personnel of the Council on Dental Therapeutics and the rules of the Council.

Dr. Palmer has written for the public, but the dentist also will read the book with enjoyment and edification. He will respond to the logic, the easy but dependable phrase, the indisputable truth in every statement with a personal professional pride. He will be saved the inevitable questions: "What tooth paste should I use? Is it true 'four out of five have it'?" and their ilk. The layman will find no professional jargon to confuse him, no rancor to distress him, no straining for a two-edged sarcasm to bolster arguments, but the treatment of vital subject with a sincerity of expression that is always the mark of good writing and is in itself the charm of good reading.

T.

CORRESPONDENCE

"History and Development of Dentistry in Mexico"

To the Editor: In his "History and Development of Dentistry in Mexico," in the June issue, H. G. Whittlesey omitted a very important fact, the basis of one of the most important dental developments since the beginning of dentistry.

In his "Primitive Contemporaries," p. 367, J. P. Murdock gives the following: "The Aztecs termed gold 'an excrement of the gods.' They cast it by the cire-perdue method. On a core of clay and charcoal, incised with the desired design, the artist built up a wax model of the object to be cast, and covered the core and model with a shell of charcoal and clay. When the whole was fired, the wax melted away, leaving a hollow earthen model. Molten gold was then poured in, the model broken and the article cleaned and polished."

Dr. Taggart very cleverly adapted this process to dental purposes. That adaptation entitles Dr. Taggart to a niche in the Dental Hall of Fame. That it was an adaptation does not lessen its value in the least or detract from Dr. Taggart's achievement. Every invention is an adaptation.

The Filipinos had an exhibit of the process at the St. Louis Fair about the time that Dr. Taggart presented the system to our profession. The Spaniards, in all probability, had taken the idea from Mexico to the Philippines.

The Aztecs were conquered about 1450 and are supposed to have existed 4,000 years before the present era, so it would be difficult to estimate when the disappearing cast was first used.

G. F. Logan,
3133 North Broad St.,
Philadelphia.

"Spherical Occlusion"

To the Editor: Considering Dr. Benson's article "Spherical Occlusion" in the March issue of The Journal, I wish to say that there should not have been any consideration at all given to the development of a cone as mentioned on page 460 and illustrated in Figures 7 and 8, because he mentioned a spherical pyramid, if you please, on page 458, meaning that the curved base of this spherical pryramid would rest upon the occlusal surface of the teeth and the two condyles. This was the same as saying that the intercondyle line is not a straight line, but a curved line, an arc of a circle. (Of course, straight lines are used for convenience generally.)

Now taking the figure as it should have been in Figure 1 and performing the experiment as he directed, we have, instead of a cone, a spherical sector. This spherical sector has no application to the subject matter in any way that I can see. Neither should there have been a mention of any cylinder of revolution as spoken of on page 460 or under Figure 11. Another case of "confusion worse confounded."

Dr. Monson's theory of spherical occlusion is not the only theory on this subject and his theory and the theory of spherical occlusion are not necessarily synonymous.

J. L. Helmer,
4604 East Tenth St.,
Indianapolis, Ind.

"Relation of Tooth Evenness to Performance on Brass and Woodwind Musical Instruments"

To the Editor: It is interesting to observe what minute care was used in collecting and classifying the data for the article, "Relation of Tooth Evenness to Performance on Brass and Woodwind Musical Instruments." The authors have extended themselves in producing an original means of classification of irregularities of the anterior teeth. Sadly enough, the classification can have no further use than that to which it was put by the authors.

Lamp and Epley have proved that tooth evenness has no relation to performance on the brass and woodwinds—to which statement I agree. They have overlooked an important point—one which was not considered in their article: The playing of a single or several musical selections may be done to perfection regardless of the

evenness of the teeth, but over a long stretch of playing, the performers with uneven teeth will tire much more quickly than the one with even teeth and thin lips. This condition has given rise to the opinion that the authors have quoted, as "Irregular teeth militate against success with a cup mouthpiece (brass) instrument. . . ."

Louis H. Condy, one time vaudeville orchestra performer, band master and teacher, has made this statement: "In my experience in vaudeville, I have found that continued playing on a brass instrument causes the muscles of the mouth to become very tired. This is especially true when the teeth are irregular and may cause the performer to make mistakes that he would otherwise be able to overcome when the obicularis oris muscle is not fatigued. The same holds true for the muscles of the tongue." To combat this condition, Mr. Condy had made for his irregular teeth a form which covered the teeth and gave the lips adequate support. The form was made of a low fusing metal so that it could easily be altered. Mr. Condy wore this device for many years. Another artifice that Mr. Condy employed was the carving of the brass mouthpiece to fit the lips and teeth so as to equalize the pressure when the teeth were irregular and the lips of uneven thickness.

It is quite possible that Lamp and Epley have made a serious error in compiling their statistical data in that the subjects may have been using individually carved mouthpieces, since this has become quite a common practice. Nowhere in their article do the authors mention that the same size and shaped mouthpiece was used in all the tests. It would be interesting to know under what conditions the data were compiled.

The authors mention the use of larger diameter mouthpieces for students with thick lips as being of material aid, but what of the student with a lip of varying thickness?

S. V. Goffen,
3423 Lawrence Ave.,
Chicago, Ill.

"Osteomyelitis of the Mandible"

To the Editor: In the July issue of The Journal, an article appears under the heading "Osteomyelitis of the Mandible."

The author reviews a case history of an acute osteomyelitis starting with an aching tooth which failed to respond to treatment and which was extracted, and then continues with the history of a bone infection ending with sequestration and sequestrectomy. So far, I have no criticism to make. When the author makes the deduction that had the patient followed his instructions, "Place ice bag on side of face for twelve hours, drink plenty of water and fruit juice, take laxative in the morning, rest in bed tomorrow in case of fever or very much swelling, call me in case of trouble," such complications would not have developed, he evidences complete lack of understanding of the nature and course of an infectious process. Particularly, he emphasizes a total failure to comprehend the field of immunology, when he naively believes that the ice bag, water, fruit juices and laxative have such an assured prophylactic effect through the defensive mechanisms involved in a serious bone infection.

Such a superficial view of the nature of the determinants of bacterial invasion—to believe that a positive protection against osteomyelitis can be attained by such measures—is perfectly astounding when one sees it reprinted as scientific truth in your journal.

The basic factors determining infection are simple enough: the number and virulence of the bacteria and the resistance of the individual; a principle whose triteness detracts not a whit from its truth. The wide variations in these factors on the part of both contending forces, including tremendously involved adjustments in the ionic, hormonal and autonomic milieu, render the course of an aching tooth unpredictable in many cases, particularly the respective effects of corn whiskey or fruit juice.

The dangers inherent in the acceptance of the essayist's measures as certain, reliable prophylaxis for bone infection motivates this communication.

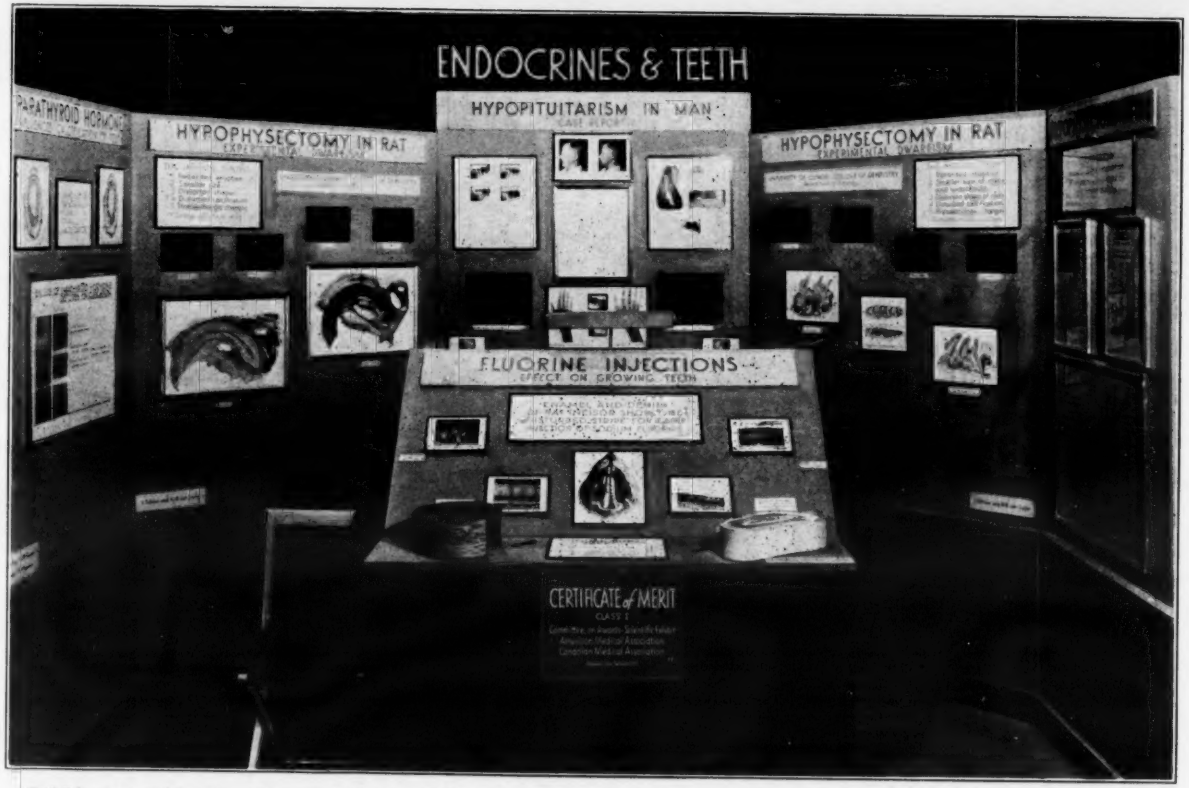


Exhibit prepared by Drs. Schour and Brodie, of the University of Illinois College of Dentistry and which received a Certificate of Merit Class I at the recent joint meeting of the American Medical Association and the Canadian Medical Association. **(See page 1390.)**

To minimize bone complications, emphasis should be placed on the selection of the *time* for surgical intervention, basing judgment on clinical evidence of an arrest or subsidence of the infection and the rising resistance of the individual. Even this is not infallible. But wo to the dental profession if it can be made to feel that osteomyelitis can be frightened away with ice bag and fruit juices.

LOUIS PARMACEK, M.D.,
55 East Washington St.,
Chicago.

NEWS

DISTRICT OF COLUMBIA

Medical Bills in Congress: S. 3084, introduced by Senator Copeland, proposes to make it unlawful in the District of Columbia for any physician, dentist or veterinarian to compound, manufacture or dispense any chemical, drug or medicine, for use as a medicine, even for his own patient, unless he has been licensed by the board of pharmacy as a medical "dispenser," dental "dispenser" or veterinary "dispenser." Physicians, dentists and veterinarians who are eligible to practice their respective professions in the District of Columbia when the bill becomes effective and who have been accustomed to compound, manufacture and dispense drugs and medicines for use by their own patients may be licensed by the board of pharmacy without examination. The qualifications of all other physicians, dentists and veterinarians are to be determined by the board of pharmacy, consisting of five pharmacists. A physician, dentist or veterinarian must pay to the board of pharmacy at the time of examination a fee of $10. Every physician, dentist and veterinarian who is licensed, whether with or without examination, must pay the board a fee of $3 when he is licensed and a like fee every three years thereafter. The board of pharmacy is to be authorized to suspend or revoke the license of any medical, dental or veterinary "dispenser" for causes stated in the act. The bill contains provisions intended to regulate the sale of poisons, including barbital and derivatives or barbituric acid. It proposes that no medicine of any kind shall be compounded, manufactured or dispensed, or sold or distributed at retail, by any person other than a registered pharmacist, except that medical, dental and veterinary "dispensers" licensed by the board of pharmacy are to be permitted to compound, manufacture and dispense drugs for the sole use of their respective patients. The board of pharmacy, if this bill is enacted, is to take over the duties of the health department and the police department in the enforcement of laws enacted for the District of Columbia and pertaining to the practice of pharmacy, the manufacture, production, sale, distribution and standard of strength and purity of drugs, chemicals and poisons. Since this bill proposes to reenact provisions of the present law relating to the treatment of persons addicted to the use of cocaine, morphine, opium and chloral hydrate, the bill proposes in effect that the board of pharmacy shall have supervision and control of the treatment of such addicts.

FLORIDA

Governor Signs Bill: May 24, Governor Sholtz affixed his signature to Senate Bill No. 524, thereby placing Florida among that ever increasing list of states which have decreed by law that fraud, chicanery and misrepresentation have no place in dentistry.

LOUISIANA

Dr. Tanner Honored: At a banquet given in his honor June 12, Peter Tanner was presented a life membership by the Fourth District Dental Society.

Held at the recent joint meeting of the American Medical Association and the Canadian Medical Association. (See page 1390.)

NEBRASKA

Bill Enacted: H. 587 has become a law, prohibiting the retail distribution or sale of barbital, sulphonethylmethane (trional), sulphonmethane (sulphonal), diethylsulphon diethylmethane (tetronal), carbonal, paraldehyde and chloral or chloral hydrate or chlorbutanol, except on the prescription of a licensed physician, dentist or veterinarian.

NEW YORK

Machine for Making Artificial Radium: An appropriation at the University of Rochester will be made to cover the cost of building a machine to manufacture artificial radium, newspapers announce. The device, called a five-million volt accelerator, will be the second of its kind in the country and will be assembled during the summer in the Bausch and Lomb Building under the direction of Lee A. Dubridge, Ph.D. The machine will manufacture artificial radium at less expense than the cost of true radium.

Society News: At the annual meeting of the New York State Dental Society in Upper Saranac, June 12-15, I. Newton Kugelmass and Douglas Quick, New York City, spoke, respectively, on "Medical Management of Dental Caries in Children" and "Cancer of the Mouth: Its Prevention and Early Diagnosis," and Dr. Arthur Z. Penta, Saranac Lake, on "The Rôle of the Oral Spirochete and Associated Anaerobes in Pyorrhea and Pulmonary Suppuration."

Dental Practice Acts: Rule Prohibiting Advertising by Dentists Declared Unauthorized: Brown and others, on behalf of themselves and all other licensed dentists in the state of New York similarly situated, sought to restrain the enforcement of Rule 8 of the Rules of the Board of Regents respecting advertising by dentists. Rule 8 declared the following form of advertising to be unprofessional and objectionable, and hence a cause for the revocation of a license to practice dentistry: The employment of letters, handbills, posters, circulars, cards, stereoptical slides, motion pictures, radio, newspapers or other advertising devices for the purpose of soliciting patronage, except that a dentist may use personal professional cards of a modest type announcing his name, title, address, telephone number and office hours. The supreme court of New York, special term, Albany County, denied the injunction, and the plaintiffs appealed to the supreme court of New York, appellate division, third department. The Board of Regents has supervisory powers over the practice of dentistry, and, "comformably to law," may prescribe canons of conduct. The legislature, by chapter 609, sec. 7, Laws of 1933, authorized the revocation of a dentist's license if he, among other things, is "guilty of untrue, fraudulent, misleading or deceptive advertising." The legislature thus set a standard for dental advertising. The rule adopted by the Board of Regents, however, is more restrictive than the statute. The Board of Regents may not make laws and, since the statute permits advertising by dentists which is not "untrue, fraudulent, misleading or deceptive," any rule adopted by the Board of Regents prohibiting advertising that does not come within the ban established by the legislature constitutes the exercise of a law-making power not possessed by the Board of Regents and a power that may not be delegated by the legislature. The supreme court, appellate division, therefore, directed a judgment restraining the defendants from enforcing Rule 8.—Brown v. University of State of New York (N.Y.), 273 N. Y. S. 809, *J.A.M.A.*, 104:2133 (June 8) 1935.

PENNSYLVANIA

Bills Passed: H. 2742 has passed the house, proposing to prohibit the sale of barbital, sulphonethylmethane (trional), sulphonmethane (sulphonal), diethylsulphone diethylmethane (tetronal), bromdiethyl-acetylcarbamide (carbromal), chloral or chloral hydrate, chlorbutanol, phenylcinchoninic acid (cinchophen), atophan, atoquinol, dinitrophenol, dinitrophenol sodium and dinitrocresol sodium, except on the written prescription of a licensed physician, dentist or veterinarian.

Dr. Turner Receives Honorary Degree:

Charles R. Turner, dean of the University of Pennsylvania School of Dentistry, received the honorary degree of doctor of science at the annual commencement of the Medical College of Virginia, May 26. Dr. Turner is an alumnus of the school.

GENERAL

Integration of the Medical Profession.—Recently, there was introduced and passed in the legislature of the state of Oklahoma a statute integrating the dental profession. In the legal profession, the movement toward integration has been under way for some years. Apparently there are movements afoot both in Oregon and in South Dakota for integration of the medical profession. This term implies the organization by statute of all licensed practitioners of medicine within a state into a public corporation, which corporation is authorized by law to determine the professional fitness of those who seek admittance to the profession in that state. The corporation would also be authorized to supervise and regulate the professional activities of every member of the profession. Thus it would determine who is and who is not eligible for admission, supervise the conduct of members, and reprimand, suspend or remove them when circumstances indicate the desirability of such action. Of course, a member expelled from a corporation would thereby cease to be authorized to practice medicine. In such an integrated profession, every licensed practitioner would be entitled to vote for the managers of the corporation and would also be assessed for the cost of its management. An integrated medical profession would therefore take over the activities of medical examining and licensing boards. The movement would not apparently have great popularity among physicians, who are, of course, on a different basis from that of either dentists or lawyers, because of the cultists of various types who enter into the practice of medicine and because of the strength and usefulness of voluntary medical organizations. Certainly until the situation has been much more extensively studied and all the possibilities worked out, the medical profession will do well to avoid being drawn into any such movement.—*J.A.M.A.*, 104:2354 (June 29) 1935.

FOREIGN

France Acts Against American Doctors: In the *Chicago Daily Tribune,* June 28, through the Associated Press, it is reported that France is forcing physicians from the United States to quit practice. The new law may also close the American Hospital. Almost all American physicians and dentists are expected to leave France because of an antiforeign medical bill which was adopted today by the senate. Thirty-five Americans are involved. The senate slightly amended the chamber of deputies version, and the bill is expected to become a law before the adjournment of parliament. The American Hospital, one of Europe's medical landmarks, probably will be abandoned. Edmond Gros, chief of the hospital staff, said all doctors attached to his staff would return to the United States in preference to accepting French citizenship. The American physicians' real objection to the bill is the retroactive principle. They admit the justice of the measure as applying to the future, inasmuch as twenty-three states in the United States have asked citizenship or a declaration of citizenship from foreign practitioners. Some of the Americans believe the government will find a way to make parliament amend the bill, since the British and Swiss embassies, as well as the United States embassy, already have protested to the foreign office.

Death of Dr. Macfarlane: Samuel S. Macfarlane, D.M.D., died June 5, at Frankfort-on-the-Main, after an operation for an obstruction in the gall duct. Dr. Macfarlane was born in Pittsburgh seventy-five years ago. He attended dental college in Baltimore and finished his course at Harvard, where he received his degree. He practiced in Pittsburgh for six years and in 1890, went to Frankfort. He was a former president of the American Dental Society of Europe.

Dr. Griswold Dead: News has been received of the death in London of William

Griswold, July 12. Dr. Griswold graduated from Northwestern University Dental School in 1897 and immediately entered practice in Hamburg, Germany. At the outbreak of the World War, he moved to London, where he practiced until his death. Dr. Griswold was the president of the American Dental Society of Europe, the last of his many visits to this country having been made a few months ago, when he arranged with many American dentists to attend the meeting of the society which opens in London July 31.

Death of Dr. Thomson: George Kerr Thomson, of Halifax, Nova Scotia, died May 2, at the age of 65. Dr. Thomson was the dean of the Faculty of Dentistry of Dalhousie University and had held many high positions in various Canadian dental associations. He was the author of authoritative articles on army dental service, preventive dentistry, etc. Dr. Thomson was in active practice forty-one years.

Deaths

Crandall, William G., Los Angeles, Calif.; died June 17.

Doxtater, LeRoy W., New York City; University of Michigan, School of Dentistry, 1909; died June 17, of heart disease; aged 49. Dr. Doxtater was widely known as a prosthetist.

Gantz, Henry H., Albia, Iowa; died May 3; aged 78.

Goetsch, Raymond W., Milwaukee, Wis.; Marquette University College of Dentistry, 1926; died recently, aged 31.

Gropper, Adolph, Milwaukee, Wis.; died May 14; aged 76.

Heiny, Fred W., Marathon, Iowa; State University of Iowa, College of Dentistry, 1909; died May 6; aged 49.

Miller, Victor Irvin, Shreveport, La.; Ohio State University, College of Dentistry, 1899; died April 11; aged 61.

Schnaidt, Edward J., Menno, S. D.; Northwestern University Dental School, 1905; died July 9; aged 53. Dr. Schnaidt was president of the South Dakota State Dental Society in 1934.

Sooey, Harry E., Chicago, Ill.; Chicago College of Dental Surgery, 1916; killed July 6, in an automobile accident.

Squire, Daniel H., Buffalo, N. Y.; University of Buffalo, School of Dentistry, 1893; died July 6. Dr. Squire was dean of the University of Buffalo, School of Dentistry.

West, Jesse A., Sioux City, Iowa; Northwestern University Dental School, 1900; died May 3.

Wickham, C. C., Long Beach, Calif.; died May 10.

Worthington, Edison, Spokane, Wash.; Chicago College of Dental Surgery, 1902; died June 25; aged 64.

ANNOUNCEMENTS*

Calendar of Meetings

American Dental Association, New Orleans, La., November 4-8.

American Academy of Periodontology, New Orleans, October 31-November 2.

American Academy of Restorative Dentistry, New Orleans, November 2-3.

American Congress of Physical Therapy, Kansas City, Mo., September 9-12.

American Society of Oral Surgeons and Exodontists, New Orleans, November 1-2.

American Dental Society of Europe, London, July 31-August 3.

Association of American Women Dentists, New Orleans, November 4.

Belgian National Dental Congress, Brussels, August 1-4.

Greater New York December Meeting, New York City, December 2-6.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

International Dental Congress, Vienna, Aug. 2-9, 1936.

International Dental Federation, Brussels, Belgium, August 4-10.

Midseason Clinic of the Connecticut State Dental Association, New Haven, November 14.

National Board of Dental Examiners, New Orleans, November 2-3.

Odontological Society of Western Pennsylvania, Pittsburgh, October 15-17.

Southwestern Society of Orthodontists, Houston, Texas, October 31-November 2.

Montreal Dental Club Fall Clinic, October 17-19.

American Dental Assistants Association, New Orleans, November 4-8.

American Dental Hygienists' Association, New Orleans, November 4-8.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

April

Connecticut, at Stamford (15-17)

May

Illinois, at Peoria (12-14)

STATE BOARDS OF DENTAL EXAMINERS

New Jersey, December 2-7. John C. Forsyth, 140 W. State St., Trenton, Secretary.

Wisconsin, at Milwaukee, December 9-13. S. F. Donovan, Tomah, Secretary.

CONNECTICUT STATE DENTAL ASSOCIATION

The next meeting of the Connecticut State Dental Association will be held at Yale Medical School, New Haven, November 14, as a mid-season clinic. The annual meeting and convention will be held at Stamford, April 15-17, 1936.

C. W. Vivian, *Secretary,*
58 Elbridge Road,
New Britain.

ILLINOIS STATE DENTAL SOCIETY

The seventy-second annual meeting of the Illinois State Dental Society will be held at Peoria, May 12-14, 1936.

Ben H. Sherrard, *Secretary,*
300 Rock Island Bldg.,
Rock Island.

GREATER NEW YORK DECEMBER MEETING

The eleventh Greater New York December Meeting will be held December 2-6 at the Hotel Pennsylvania, New York City.

George C. Douglass, *Chairman*
Press and Publication Committee.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The American Society of Oral Surgeons and Exodontists will hold its seventeenth annual meeting at the Jung Hotel, New Orleans, November 1-2. The annual banquet will be held Friday evening, November 1.

Harry Bear, *Secretary,*
410 Professional Bldg.,
Richmond, Va.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The fifteenth annual meeting of the Southwestern Society of Orthodontists will be held at the Rice Hotel, Houston, Texas, October 31-November 2. An invitation is extended to all orthodontists and members of the dental profession to attend the meeting on the way to the A.D.A. meeting in New Orleans the following week.

Harry H. Sorrels, *Secretary,*
Medical Arts Bldg.,
Oklahoma City, Okla.

NATIONAL BOARD OF DENTAL EXAMINERS

The next meeting of the National Board of Dental Examiners will be held at the Roosevelt Hotel, New Orleans, November 2-3.

R. P. Thomas, *Secretary,*
Heyburn Bldg.,
Louisville, Ky.

STATE BOARD OF REGISTRATION AND EXAMINATIONS IN DENTISTRY OF NEW JERSEY

The State Board of Registration and Examinations in Dentistry of New Jersey will hold its annual examinations, commencing Monday, December 2, 1935, and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application, together with the examination fee of $25, on or before March 15 for the succeeding June examinations, or before September 1 for the succeeding December examinations.

JOHN C. FORSYTH, *Secretary,*
148 West State St.,
Trenton.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The next examination to be conducted by the Wisconsin State Board of Dental Examiners will be held at Marquette Dental College, Milwaukee, December 9-13. For further information, address

S. F. DONOVAN, *Secretary,*
Tomah.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The eleventh annual meeting of the American Dental Assistants Association will be held at New Orleans, November 4-8. Headquarters will be at the Bienville Hotel. For further information, address

LUCILE S. HODGE, *General Secretary,*
401 Medical Arts Bldg.,
Knoxville, Tenn.

POSTGRADUATE DENTAL EDUCATION THROUGH SCHOLARSHIPS

The Children's Fund of Michigan announces the establishment of seventeen scholarships covering the period Oct. 1, 1935, to June 1, 1936. These scholarships are available to graduates of Class A American and Canadian dental schools who shall have done better than average work while in dental school attendance, and who are recommended by the deans of the schools from which they were graduated. Recipients of scholarships will receive postgraduate training in a course of sixty-four lectures and clinics covering the following subjects: oral surgery; children's dentistry; full denture prosthesis; partial denture prosthesis; dental caries, dental pathology, and pyorrhea; dental medicines and therapeutics; root canal surgery and roentgen rays; amalgam; dental materials; crowns and bridgework; orthodontia; office management and applied psychology; silicates and cements; gold inlay; medical subjects; dental ethics, and public health. Instruction will be given by the Department of Postgraduate Medicine and the faculties of the Medical and Dental schools of the University of Michigan, including other outstanding dentists in the state. Students in the course may register for a Certificate of Proficiency from the Dental Unit of the Division of the Health Sciences in the University of Michigan, or for a master's degree in the graduate school, registration to be subject to the existing requirements of the university. All students doing acceptable work will receive a Certificate of Attendance on completion of the course. Opportunity to gain practical experience will be afforded successful applicants by employment in the Detroit Dental Staff. Further field experience may be gained at the close of the course by employment in the 1936 Summer Dental Relief Program, and opportunity to advance to a position on the regular program staff will be afforded one or more of the most proficient members of the class. For complete details, communicate with

K. R. GIBSON, *Director Dental Division,*
Children's Fund of Michigan,
660 Frederick Street,
Detroit, Mich.

OMICRON KAPPA UPSILON

There will be a luncheon for members of Omicron Kappa Upsilon at 12 o'clock noon, Wednesday, November 6, at the Roosevelt Hotel, New Orleans. A short program will be provided. All members who are in at-

tendance at the convention of the American Dental Association are urged to be present. Dr. F. J. Genre of 6363 St. Charles Avenue is chairman of the local committee.

ABRAM HOFFMAN,
Supreme Secretary-Treasurer,
311 East Chicago Ave.,
Chicago, Ill.

AMERICAN SOCIETY FOR THE PROMOTION OF DENTISTRY FOR CHILDREN

The ninth annual meeting of the American Society for the Promotion of Dentistry for Children will be held at the Roosevelt Hotel, New Orleans, November 4.

WALTER T. MCFALL, *Secretary,*
106 Forrest Ave., N. E.,
Atlanta, Ga.

F. D. I.

Honorary Members: The Committee of Organization has the right to elect honorary members. An honorary member is entitled to all the privileges of an active member without payment of any subscription. Associate Members: The following may be admitted as associate members of the Congress: 1. Relatives of members of the Congress. 2. Students in dentistry or medicine. 3. Trade exhibitors or their representatives. Applicants for admission as associate members must give the following information when applying: (a) Relatives: Name and address of the active member to whom they are related (stating relationship). (b) Students in dentistry and medicine: Proof of registration as dental or medical students. (c) Trade exhibitors: Proof of participation in the exhibition. The subscription is: for students, 15 schillings austrian; for all other associate members, half the subscription of active members (35 or 30 schillings austrian). A person having the required qualifications of an active member of the Congress can only be admitted as such. No person can be admitted as an active or an associate member before receipt of the subscription. As soon as the admission is approved, the applicant will receive a membership card. This card will bear the signatures of the president and the treasurer, and will serve as a receipt for the subscription. Entrance to the Congress can be obtained only on presentation of this membership card, which must bear the name and signature of the person to whom it was issued. The membership card is not transferable. The administrative secretary must be informed immediately of any change of address. Active members will receive the official program, the catalog of the exhibition and the transactions of the Congress, which will be published in two volumes. Associate members will receive the official program and the catalog of the exhibition. Only active members who have applied and paid before April 1, 1936, are entitled to receive the transactions. Other members will receive copies of the official documents of the Congress only if there are any left over.

CORRECTION

In line 9, second column, page 898, May issue, "white wheat bread" should read "whole wheat bread."

WARNING AGAINST SWINDLER

The following warning has been received from a member in Hammond, Ind.: One M. C. Carson, posing as a suit salesman for the Southern Mfg. Company of Rome, Ga., selling summer suits at attractive prices, and armed with apparently authentic credentials, is preying on professional and business men throughout the Middle West. The Southern Mfg. Company avers that they have no connection with M. C. Carson, but will credit deposits paid to him, if order is desired filled. Carson is about 5 feet 9 inches tall, weighs about 200 pounds, has light hair, is inclined to baldness and talks with a distinct Southern accent.

AMERICAN DENTAL ASSOCIATION

New Orleans, La. November 4-8, 1935.

HOTEL RESERVATION

In securing hotel reservations for the 1935 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

In case your first choice cannot be made, kindly indicate second and third choices. If none of your choices are available, the hotel manager will mail your application to the Chairman of Halls & Hotels Committee, who will make as favorable reservation for you as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing the room reserved for you in order that it may be available to others attending the meeting.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, NEW ORLEANS, LA., NOVEMBER 4-8, 1935.

.....Hotel.
New Orleans, La.

Please reserve sleeping accommodations as noted below:

.....Room (s) With bath for.....people. Rate desired per day $.....

.....Room (s) Without bath for.....people. Rate desired per day $.....

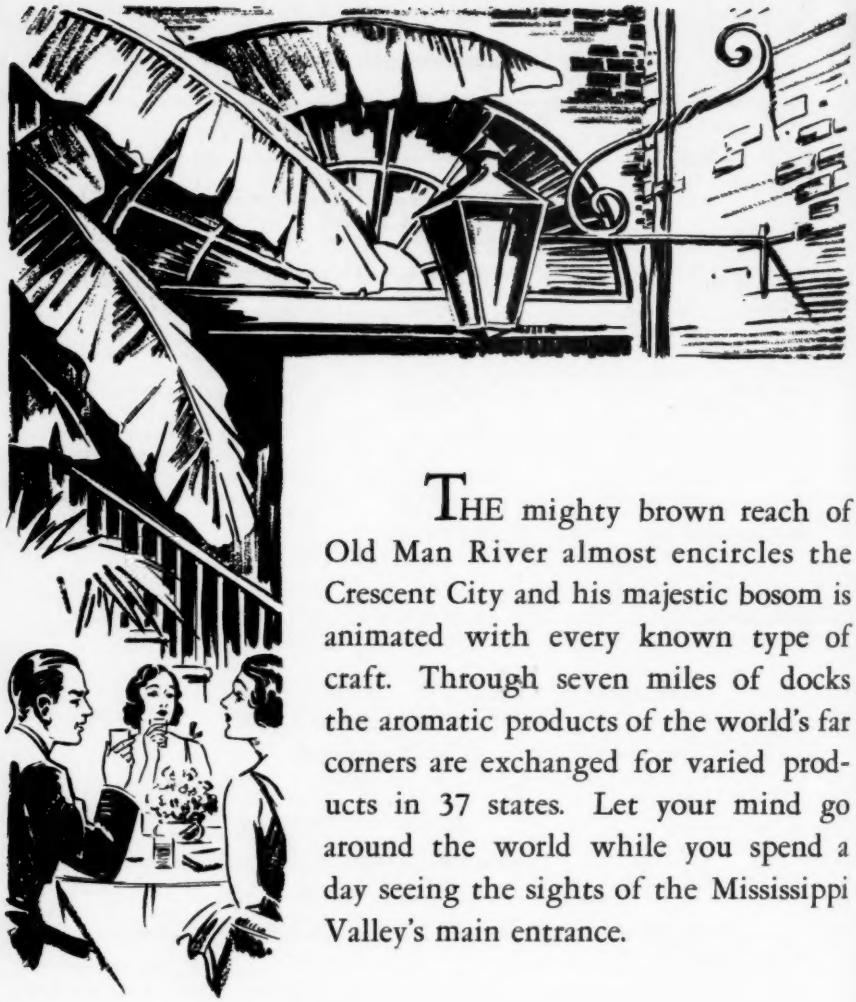
Second choice hotel..... Third choice hotel.....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
Applicant.....	.....
.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. G. O. Rosado, Chairman Halls & Hotels Committee, 827 Maison Blanche, New Orleans, La., who will attend to the assignment of this reservation.

HOTEL	WITH BATH		
	One Person	Two Persons	Twin Beds
BIENVILLE HOTEL Lee Circle	$2.00–2.50 3.00–3.50	$3.50–4.00 5.00	$5.00–6.00 7.00
DE SOTO HOTEL 420 Baronne Street	2.00–2.50 3.00–3.50 4.00	3.50–4.00 4.50–5.00	5.00–6.00 7.00
JUNG HOTEL 1500 Canal Stteet	2.50–3.00 3.50–4.00	5.00–6.00	6.00–7.00 8.00
LA SALLE HOTEL 113 Canal Street	2.00–2.50 3.00	3.50–4.00 5.00	5.00–6.00
HOTEL MONTELEONE 214 Royal Street	2.50–3.00 3.50–4.00	5.00–6.00	6.00–7.00 8.00
HOTEL NEW ORLEANS 1300 Canal Street	2.00–2.50 3.00–3.50	3.50–4.00 5.00	5.00–6.00
PONTCHARTRAIN APT. HOTEL 2031 St. Charles Avenue		5.00–6.00	
ROOSEVELT HOTEL 123 Baronne Street	3.00–3.50 4.00–4.50 5.00–6.00	5.00–6.00 7.00	7.00–8.00 9.00
ST. CHARLES HOTEL 211 St. Charles Street	2.50–3.00 3.50–4.00 4.50–5.00	4.50–5.00 6.00–6.50	6.00–7.00 8.00



THE mighty brown reach of Old Man River almost encircles the Crescent City and his majestic bosom is animated with every known type of craft. Through seven miles of docks the aromatic products of the world's far corners are exchanged for varied products in 37 states. Let your mind go around the world while you spend a day seeing the sights of the Mississippi Valley's main entrance.

Attend the ADA

What the meeting will mean to you.

A. Tonic for body and mind.
D. Rest when rest is needed.
A. Renewal of hope and enthusiasm

That is what the meeting will mean to you

The 77th Annual Session

of the

AMERICAN DENTAL ASSOCIATION

in NEW ORLEANS

November 4 to 8, 1935

CONVENTION

New Orleans Nov. 4-8. 1935

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1934-1935

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